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CANMET ANNUAL BIBLIOGRAPHY OF CRUSHING AND GRINDING - 1986

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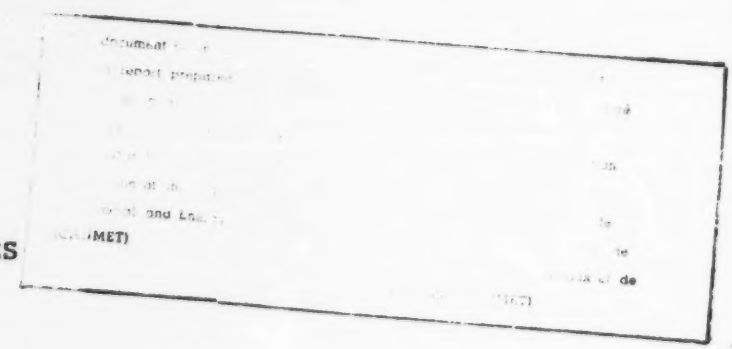

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CANMET BIBLIOGRAPHY OF CRUSHING 1986

BY

D.C. LUMB

ABSTRACT

This report is a comprehensive bibliography of the latest developments in machinery, techniques and crushing-grinding circuits for the year 1986.

Keywords: Crushing, Grinding, Crushing Mill, Grinding Mill, Grinding Circuit, Process Control, Automation.

RÉPERTOIRE BIBLIOGRAPHIQUE DES TECHNIQUES DE CONCASSAGE ET DE BROYAGE UTILISÉS EN 1986 - TRAVAIL RÉALISÉ PAR CANMET

PAR

D.C. LUMB

RÉSUMÉ

Ce rapport constitue une bibliographie exhaustive de la machinerie, des techniques et circuits de concassage et de broyage les plus récents utilisés en 1986.

Mots clé: Concassage, broyage, appareils de broyage, broyeurs, circuits de broyage, contrôle des opérations, automatisation.

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CANMET ANNUAL BIBLIOGRAPHY OF CRUSHING 1986

INTRODUCTION

This report presents bibiliographical information on the subject of crushing and grinding. Articles were categorized and numbered sequentially according to the yearly quarter in which they were cited. Althogh some ambiguity may exist in the article allocations, the categories were chosen to facilitate specific subject searches while retaining the convenience of a general breakdown.

REFERENCING SYSTEM

The references in this report were obtained through the CAN/SDI system covering the 1986 issues of the following data bases:

CHEMICAL ABSTRACTS
COMENTDEX
METADEX (Metals Abstracts)
NTIS (National Technical Information Service of the U.S. Dept. of Commerce)
SCIENCE CITATION INDEX

The references were numbered according to the months in which the data bases cited the reference. A photocopy of each article was made and may be found filed according to its reference number at the CANMET Ore Dressing Laboratories, 552 Booth St. Also at the same location is an author-index listing various authors and their articles for which photocopies have been made.

The references appearing in this report were numbered according to the following method:

January, February, March 1986	2900 - 2957
April, May, June, 1986	3000 - 3040
July, August, September, 1986	3100 - 3151
October, November, December 1986	3200 - 3233

ACKNOWLEDGEMENT

I would like to thank the support and cooperation of W.H. Cameron, J. MacCauley, Canada Centre for Mineral and Energy Technology, and Energy, Mines and Resources Canada.

1986 (A) REVIEW AND GENERAL ARTICLES

2902 Adorjan, L.A. (Technical Univ. of Nova Scotia, Dep. of Mining & Metalurgical Engineering, Halifax, NS, Can.), "Mineral Processing Innovations"; Can. Metall. Q., Vol. 24, No. 1, Jan.-Mar. 1985, pp. 15-25; 26 Refs.; ISSN 0008-4433; CAMQA

A533; A802; 1 - Ore Treatment - Reviews; Chemical Equipment - Cyclones; Filters; Crushers; Spirals; Separators; Thickeners; Sorters; Electrofilters

Treat: G (General Review)

Some recent technological advances in mineral processing are outlined. The topics selected include: centrifugal mills, the centrifugal fine crusher, ore bed magnetic mill linings, Reichert spirals, Knelson concentrators, tri-flo separators, density tracers, permroll separators, ferrous wheel separators, magnetic hydrocyclone thickeners, ore sorters and the electrofilter (edited author abstract).

2920 Sarkar, G.G. (Indian Sch. of Mines, Dhanbad, India), "Simplified Approach to Ensure Specified and Consistent Quality of Coal Supplies to Thermal Power Stations at Economic Cost"; J. Mines Met. Fuels, Vol. 32, No. 7, July 1984, pp. 356-364; 18 Refs.; ISSN 0022-2755; JMMFA

A524; A614; A913; A503; A911; 1 - Coal Preparation - Breakage; Steam Power Plants - Fuels; Coal - Quality Assurance; Coal Pulverizers; Coal Industry - India; Crushing and Grinding - Economics; Impact Breakers; Multiphase Impact Breaking; Thermal Power Stations

Treat: A (Applications)

In the process of crushing and grinding of coal to pulverized fuel at least 3 to 4 stages of unit operations are involved. As in most cases, the crushing and grinding are done by compression and/or attrition, not only the hard stones or shale are reduced to finer sizes along with the coal causing all the operational and maintenance hazards in the concerned sections of a power plant, but also energy requirements as well as outages of crushing and grinding units are often steeply enhanced. Most of these problems and infructuous costs involved therein can be avoided or minimized if the step-wise size-reduction is conducted primarily with the aid of conventional and improved types of impact breakers,

which are now being specially designed and marketed for such application. Based principally on multiphase impact-breaking of coals consumed in Indian power stations, a more simplified and economic procedure for the preparation of such coals is outlined. The salient features of this scheme, proposed for the first time in any country, is outlined.

2935 Muir, W.W., "The Baker Mill Start-up and Early Operation"; Can. Min. Metall. Bull, (Nov. 1985), Vol. 78, No. 883, pp. 55-61; ISSN 0317-0926

42; Gold, Extractin; Silver, Extraction; Grinding (Comminution); Leaching; Cyaniding

The Baker Mine used a 100-ton/day conventional cyanide leach mill located in northern British Columbia (Canada). A production decision was made in early 1980 and the mill was on line in April 1981. Ore reserves had been estimated at 100,000 tonns averaging 0.9 oz. Au/ton and 18 oz. Ag/ton. mineralization consists of electrum (Au/Ag) and acanthite (Ag sub 2 S). Plant design and some problems associated with start-up and early operation are reviewed with the intention of assisting other mine operators by indicating potential problem areas. 4 ref.

2938 Gregr, J.G., "Grinding Mills - Installation and Maintenance"; Can. Min. Metall. Bull. (Oct. 1985), Vol. 78, No. 882, pp. 29-37; ISSN 0317-0926

41; Ball Crushers; Gears; Service Life; Plain Bearings; Service Life; Wear Resistance; Maintenance

A brief review of grinding mills installation procedures is given with special emphasis on future maintenance. The importance of cooperation between the customer, construction contractor and manufacturer's representative and the importance of complying with standards, specifications and the keeping of comprehensive installation records are discussed. Fundamentals of mill maintenance are explained with the aim being to maximize the equipment availability and to minimize unscheduled downtime. Development of wear items design, based on operating conditions, drive components and bearings, and how to keep large gears healthy thus eliminating surprise failures is also included. Experience with installation of a large gear on a 34-ft. dia. mill in Lornex (Canada) and successful application of a computer program for the gear alignment on the mill are given.

3003 Moir, D.N. "Size Reduction"; Chem. Eng. (NY), 16 Apr. 1984, Vol. 91, No. 8, pp. 54-68; ISBN: ISSN 0009-2460

41; Ores, Beneficiation, Comminution, Crushers, Design, Grinding Mills

Consideration is given to size reduction processes, principles, equipment, testing and modelling, process variables, i.e. feed material, desired particle size, size-reduction flowsheet, energy and wear, capital and operating costs and protecting costs and protecting equipment from damage are defined. Size-reduction equipment is described, including gyratory crushers, tumbling mills, autogenous mills, rod mills, ball mills, fine-graining equipment (air-classifying and pin mills, roller, bowl, and ring-ball mills, high-speed hammermills, vibratory mills, fluid-energy mills and bead and sand mills). Advances in efficiency are explained, including spiral linings for ball mills, grinding additives, centrifugal grinding mills and cyrogenic crushing. Testing and prediction methods are cited, including hardgrove index, bond ball-mill test and bond impact test and computer modelling. 31 ref.

3023 Anon. "Comminution at San Manuel and Toquepala", International Mining, December 1985, Vol. 2, No. 12, pp. 25-27

3030 Burger, John R. (Engineering and Mining Journal, New York, NY, USA), "Exxon Trims Chile Copper Plans to Fit Cost Escalation: But Disputada Is Still Expanding Production in the High Andes and in the Coastal Range"; Eng. Min. J., Vol. 186, No. 2, Feb. 1985, pp. 26-32; ISSN 0095-8948; ENMJA

A504; A443; A533; A405; 1 - Copper Mines and Mining - Design; Snow and Snowfall - Avalanches and Slides; Copper Ore Treatment - Crushing and Grinding; Rock Drilling; Copper Deposits - Chille; Artillery; Vertical Crater Retreat (VCR); Reconstruction; Tramways; Slurries

Treat: A (Applications)

Less than six months after Exxon bought the Los Bronces Copper mine as part of its purchase of CIA. Minera Disputada de las Condes S.A., an avalanche roared down on the mine's concentrating plant, totally destroying the electrical substation, flotation, regrinding, thickening, and concentrate handling equipment. The 7,000-Mt-D plant had been linked to the mine by a high-cost, avalanche-vulnerable aerial tramway and there had

been an additional problem - the secondary and tertiary crushing plants had a limited capacity that was further reduced when processing muddy material during periods of thaw. Rather than rebuild around these old problems, it was decided to work at eliminating them. The subsequent studies and tests resulted in the first installation of a semiautogenous mill in South America and replacement of the tramway with a slurry pipeline.

3040 Mis'nik, V.A., Khmel'kovskii, I.E. (Siberian Nonferrous Metal Scientific-Research & Planning Inst., Krasnoyarsk, USSR), "Mill Operation in a Closed Cycle while Crushing Mineral Mixtures", Sov. Min. Sci., Vol. 20, No. 6, Nov.-Dec. 1984, pp. 473-478; 3 Refs.; ISSN 0038-5581; SMNSA

A533; A921; A913; 1 - Ore Treatment - Crushing and Grinding; Mathematical Models; Productivity; Crushability; Time

Treat: T (Theoretical)

Crushability of the ore in the kinetics equation given is defined by the characteristic time for crushing which is needed to reduce the coarse-class content in the mill by E (E is the natural-logarithm base). It is also defined by the index, which determines the form of the dependence. The mathematical model permits prediction of mill productivity in relation to its operating regime and composition of its mineral mixture.

3108 Brown, C.M., Pipke, M.A. (Utah Mines Ltd., Port Hardy, B.C., Can.), "Island Copper Grinding Circuit - A Progress Review"; Miner. Metall. Process., Vol. 3, No. 2, May 1986, pp. 122-136; 11 Refs; ISSN 0747-9182; MMPRE

A533; A504; 1 - Copper Ore Treatment - Crushing and Grinding; Grinding Mills - Performance; Copper Deposits - British Columbia; Semiautogenous Grinding Circuit; Island Copper; Porphyry Copper Ore

Treat: A (Applications)

The semiautogeneous grinding circuit at the Utah Mines Ltd., Island Copper operation, located on Vancouver Island, British Columbia, is described. Since startup of the operation in 1971, grinding circuit throughput has been progressively increased from the initial design rate of 30,000 to the current average 45,000 t/d of porphyry copper ore. Key developments and

modifications in operating and maintenance practice that have contributed to this increase are reviewed. (Edited author abstract).

3134 Scheibe, Wolfgang (Inst. fuer Berbausichereit), "Some New Developments in the Field of Fine Comminution / Zu einigne Entwicklungstendzen auf dem Gebiet der Feinzerkleinrung"; Neue Bergbautech, Vol. 14, No. 7, July 1984, pp. 265-270; Refs.; ISSN 0369-3643; NEBBA

A533; A802; A531; 1 - Crushers - Design; Grinding Mills - Design; Crushing and Grinding - Costs; Ore Treatment - Crushing and Grinding; Fine Comminution

Treat: G (General Review)

The article describes some new develpments in field of crusher and grinding mill designs especially for fine comminution. In German.

3157 Anon. (Soc. de l'Industrie Minerale, Section Mineralurgie, St.-Etienne, Fr)., "Round Table of the Ore Treatment Section, Paris, December, 1983 / Table Ronde, Section Mineralurgie", Ind. Miner. Tech., No. 9-84, Nov. 1984, Table Ronde, Sect. Mineralurgie, Paris, Fr., Dec. pp. 677-726; INMTD

A531; A921; A922; A802; 1 - Ore Treatment - Mathematical Models; Statistical Methods; Crushing and Grinding; Flotation; Ore Treatment Equipment; Process Representation Methods; EIREV

Treat: G (General Review); T (Theoretical)

The conference proceedings contains 7 papers covering the use of mathematical modelling of the ore treatment processes such as crushing and grinding, flotation, separation, and beneficiation. The papers are in French, except one in English. Technical and professional papers from this conference are indexed and abstracted with the conference code no. 06350 in the EI engineering meetings (TM) database produced by Engineering Information Inc. In French and English.

3203 Crandell, A.L. (Cortez Gold Mines, Cortez, N.V., USA), "Conversion of the Cortez Gold Mining CCD Circuit to CIL"; Min. Eng. (Littleton, Colo.), Vol. 38, No. 9, Sep. 1986, pp. 888-892; 3 Refs; ISSN 0026-5187; MIENA

A502; A504; A531; A533; 1 - Gold Mines and Mining - Operations Research; Gold Ore Treatment - Leaching;

Countercurrent Decantation; London Extension Dump; Mill Conversion from CCD to CIL; Heap Leaching

Treat: A (Applications); G (General Review)

The major factor in the decision to convert the mill from CCD to CIL was that carbon-in-leach has 7% better recovery rates than CCD on the London extension ore. One reason for this difference was CIL produced a lower soluble loss to tailings than did the CCD. This was because the high clay content of the London extension ore caused poor washing efficiencies in the thickener washing circuit. Laboratory testwork has indicated that CIL gives better recovery than CCD on ore containing preg robbing carbonaceous material. There are other ore reserves in the area that contain preg robbing carbonaceous materials. This also contributed to the decision to convert the Cortez mill from CCD to CIL.

3213 Jung, O, Ozturk, M., "Grinding Drying Plant with MPS Roller Mill for Turkish Hard Lignite - Design, Construction, Operation", Zement-Kalk-Gips, Vol. 39, No. 8, 1986, pp. 434-439; Ref: 000

3233 Bignell, J.D., Newton, S. (Warren Spring Lab, Stevenage, Engl.), "Recent Progress in Solids Processing: Cominution - A Review"; Chem. Eng. Res. Des., Vol. 64, No. 2, March, 1986, pp. 91-93; 31 Refs.; ISSN 0263-8762; CERDE

A533; A802; 1 - Crushing and Grinding - Equipment; Crushers; Grinding Mills; Strontium Ferrite Magnetic Mill Linings; Comminution; Autogenous Grinding; Vertical Spindle Mills

Treat: G (General Review)

Recent trends in crushing technology have been to extend the range of use of crushers such as vertical spindle mills to finer sizes and the deployment of movable primary crushers that can be placed close to the working face to maximize the use of the conveyor transport of material. For grinding process interest has focussed on the concept of centrifugal milling, the extension of stirred media mills to treating coarse, material (Tower Mills) and the use of magnetic liners. Improvements in the design and operation of comminution - classifying circuits should follow from the modelling studies currently in progress (Edited author abstract).

1986 (B) CRUSHING

2901 Sassos, M.P., "Primary Crushers, Feeder - Breakers", Eng. Min. J. (Sept. 1985), Vol. 186, No. 9, pp. 51-54, 56, 58; ISSN 0095-8948

41; Crushers; Mills

An overview is provided of some of the latest developments and recent models of primary crushing and feeder-breaker equipment. All information is based on printed material supplied to E & MJ by the following equipment manufacturers: Rexnord Inc., Kone Corp., Eagle Crusher Co., Svedala-Arbra Ab, Krupp Industrietechnik, W.R. Stamler Corp., Ingersoll-Rand, Voest-Alpine International Corp., PHB Weserhutte Ag, Universal Engineering Corp., Hewitt-Robins, Hazemag USA Inc., Lippman Milwaukee Inc., McLanahan Corp., and Pennsylvania Crusher Corporation.

2907 Bottacin, G., "Crushing Technology for Moist, Plastic and Sticky Materials"; Zement-Kalk-Gips, Vol. 38, No. 12, 1985, pp. 699-700; Ref: 000

2908 Schonert, K., "Sizing of High Pressure Twin-Roll Mills"; Zement-Kalk-Gips, Vol. 38, No. 12, 1985, pp. 728-730; Ref: 000

2916 Kuga, Yoshikazu, Koga, Jiro, Yamaguchi, Kenji, Inoue, Ichiro (Inst. of Physical and Chemical Research, Powder Technology Lab, Wako, Jpn), J. Chem. Eng. Jpn, Vol. 18, No. 3, June 1985, pp. 270-273; 8 Refs.; ISSN 0021-9592; JCEJA

A802; A804; 1 - Crushing and Grinding; Powders; Feed Size; Impact Crushing; Screen Mill; Selection Function

Treat: X (Experimental)

In this work from a comparison of the kinetic parameters of the screen mill with those of crushing by one perpendicular collision of a particle with impact elements (hereafter, this is simply described as crushing by one collision), the comminution mechanism of the mill might be more complex than that of crushing by one collision because of random motion of particles by air stream turbulences and inertia. The effects of operating conditions on impact crushing in the mill per unit time, proposed in this work, were studied. It is found that the calculations for various feed sizes suggest that the size distribution of product is almost

independent of the feed size. This tendency is also observed in the experimental results for the product size distribution of the screen mill.

2918 Faddeenkov, N.N., Taran, E.P., (Acad. Sci. USSR, Inst. Min. Novosibirsk, USSR), "Lump Size and Energy Use in the Zone of Active Crushing"; Soviet Mining Science, USSR, Vol. 21, No. 1, 1985, pp. 66-70; Ref: 012

2923 Goell, G., Koenig, S., "On the Influence of Different Shapes and Materials of Hammers on the Crushing Results"; Neue Bergbautech. (Jan. 1985), Vol. 15, No. 1, pp. 28-31; ISSN 0047-9403
41; SR; Structural Steels, Mechanical Properties; Brasses, Mechanical Properties; Aluminum, Mechanical Properties; Impact Strength; Hammer Mills, Materials Selection; ST35: SR

Experimental studies of pulverization of glass spheres and calcite pieces are reported. The test aparatus, operated by compressed air, is illustrated along with an enlarged view of the cross-section of the hammer and impact plate. Four different materials, i.e. hard metal HG40, structural steel ST35, brass and Al have been tried. From the results shown on a curve, the break distribution probability curve has been derived as a logarithmic curve related to the stress energy in J/G. Hard metal hammers are found to be best and calcite has roughly 20% more probability of being powdered than glass. The effects of other parameters, e.g. shape of parts, surface area, grain structures and energy consumption are also discussed. 14 Ref.

2925 Durney, T.E., Meloy, T.P.,(W. Virginia Univ., Ctr. Particle Anal. Morgantown, WV 26506) "Particle-Shape Effects Due to Crushing Method and Size";, International Journal of Mineral Processing", Vol. 16, No. 1-2, 1986, pp. 109-123; Ref: 022

2927 Hill, H.E., (Croft Impresa Ltd.), "Vertical-Shaft Impact Crushers", Quarry Manage., Vol. 12, No. 10, Oct. 1985, pp. 713-718; 721-722; QUMAE

A533; A911; 1 - Crushers; Vertical-Shaft Impact Crushers

Treat: G (General Review)

There are basically two types of vertical impact crusher; the stone-on metal design and the stone-on-stone design. The capital cost of the stone-on-stone type shows a saving when compared with cone crushers.

Vertical impact crushers can be used to produce specification sand sizes, for differential crushing, for metal reclamation and for crushing abrasive materials such as corundum and even steel.

2931 Broman, John, "Optimizing Capacity and Economy in Jaw and Gyratory Crushers", Eng. Min. J., Vol. 185, No. 6, June 1984, pp. 69-71; 12 Refs.; ISSN 0095-8948; ENMJA

A533; A921; 1 - Crushers - Optimization; Ore Treatment - Crushing and Grinding; Cyratory Crushers; Jaw Crushers

Treat: T (Theoretical)

Because of the complex nature of jaw and gyratory crushers exact formulas can never be set for determining their capacity. Many fundamental aspects of the crushing process cannot be observed directly, and approximations must be accepted. In their simplest form, capacity calculations have been based on the discharge area only. For a serious evaluation of crushing capacity, attention must be given to the influence of NIP angles, stroke, speed, etc., and to the material used in wearing members.

2937 Grieco, F.W., Grieco, J.P., "Manufacturing and Refurbishing of Jaw Crushers"; Can. Min. Metall. Bull, (Oct. 1985), Vol. 78, No. 882, pp. 38-42; ISSN 0317-0926

41; Jaw Crushers, Service Life; Wear Resistance; Manganese Steels, Mechanical Properties; Repair Welding; Renovating

Jaw crushers are discussed in depth. A history and detailed explanation of their method of function, discussing several types of crushers are given. What can go wrong with a crusher and how to set one up to minimize problems is explained. A detailed list to use in deciding whether to refurbish or replace a jaw crusher is included. Finally, the four major refurbishing areas: investigation with NDT of all highly stressed, worn, and suspicious areas; repair and strengthening of all major components; complete remachining of all originally machined areas; and complete assembly, alignment and dowelling are discussed. The refurbished machine should then operate like new. Under normal conditions, the cost should be 60-70% of a new machine. The refurbishing may take from three to six months.

2939 Dolgov, K.A. (LGI, Leningrad, USSR ISU)), "Effect of Charge Interaction on the Blast Crushing of Rocks"; IZV. VYSSH. USHEBN. SAVED., GORN.. ZH., No. 11, 1985, pp. 67-72; ISSN 0536-1028; IVUDA

CA154001; Ferruginous Quartzite Deposit Blasting Crushing; Particle Size Ferruginous Quartzite Blasting

Partizle Size; Quartzite; Mines and Mining

2941 Rudnev, A.D., Rudnev, V.D. (Tomst Civil Engn. Inst., Tomsk, USSR), "Calculating the NIP Angle of the Chamber of Jaw and Cone Crushers with Inclusion of the Velocity Vector"; Soviet Mining Science USSR, Vol. 21, No. 2, 1985, pp. 155-159; Ref: 006

3018 Freeh, E.J., Iles, C.D. (Duval Corp, Tuscon, AZ 00000), "Experience with Operating and Controlling an In-pit Portable Crushing and Conveying System"; In: Norrie, A.W., Turner, D.R., Automation for Mineral Resource Development, 1986, pp. 153-158; Ref: 000; Pub: Pergamon Press Ltd., Headington Hill Hall, Oxford OX3 0BW, UK

Symp. on Automation for Mineral Resource Development. Held: Brisbane, Australia, 85/7/9-11

IFAC Proceedings Series

LC: 85-21844 ISBN: 0-08-031663-8

3026 Kelly, John G. (Sherritt Gordon Mines Ltd., Fox Operations, Man., Can), "Choice of Rockbreakers at Sherritt's Fox Mine"; CIM. Bull., Vol. 79, No. 885, Jan. 1985, pp. 50-55; 2 Refs.; ISSN 0317-0626; CIBUB

A504; 1 - Copper Zinc Mines and Mining - Crushing and Grinding; Copper Zinc Deposits - Canada; Rockbreakers; Sherrit's Fox Mine, Canada; Jaw Crusher

Treat: X (Experimental)

An extensive study was carried out to determine the best means of size reduction for the ore to be hoisted through a borehole hoisting system. The study examined three alternatives: a jaw crusher, pneumatic rockbreaker(s) at Grizley, and hydraulic rockbreaker(s) at a Grizzly. The final decision was a compromise between alternatives 2 and 3. Two rockbreakers, one pneumatic and one hydraulic, were installed over a single grizzly. This paper compares the three systems. (Edited author abstract).

3032 Zdenko, Ceraj A. (Omarska-Prijedor Complex), "Mobile Crushing at Omarska"; Eng. Min. J., Vol. 186, No. 7, July 1985, pp. 38-41; ISSN 0095-8948; ENMJA

A504; A533; A911; 1 - Iron Mines and Mining - Yugoslavia; Iron Ore Treatment - Crushing and Grinding; Conveyors; Economics; Mineralization; Mobile Crushing

Treat; A (Applications)

In drawing up a concept for mining at Omarska, Yugoslavia, mine planners searched for the most economical system to transport iron ore from the mine workings to the processing plant. Alternative systems considered include: ore transport by truck over a distance of 2.5 km to primary crushing in the processing plant; ore transport by truck to a stationary crushing system located in the mine area, followed by 2.0 km of overland conveying to the concentrator, and ore hauling by truck to a mobile crushing plant, followed by overland conveying to processing. This article describes the system selected - a mobile crushing plant with overland conveying - from the point of view of technical reliability and keeping operating costs to a minimum.

3035 Althoff, Heinz (O & K Orenstein & Koppel, Zementanlagen, West Ger.), "Cost Reduction by In-pit Crushing and Conveying", Bulk Solid Handl., Vol. 5, No. 1, Feb. 1985, pp. 157-159; ISSN 0173-9980; BSHAD

A691; A911; A502; A692; A602; 1 - Materials Handling - Costs; Mines and Mining - Open Pit; Conveyors - Belt; Industrial Trucks; Heavy Trucks Haulage; Mobile Crushing Plants

Treat; G (General Review)

The advantages and disadvantages of a mobile crushing plant with a belt conveyor system compared to a stationary crushing plant with haulage by heavy trucks are described. The capital expenditure and operational expenses are compared, and the individual cost factors are explained. Every open-pit mine, however, is different and has to be assessed and analyzed individually in order to find the optimum and most economical solution. Due to high truck haulage costs, many open-pit mines tend to the more economical solution with mobile crushing plants and continuous belt conveyor operation. (Author abstract)

3107 Winterhalder, Obering J., "Long-Time Operation of a Double-Roll Crusher at the Limeworks Otterbein-Mues";, Aufbereit Tech., Vol. 27, No. 4, Apr. 1986, pp. 217-221; ISSN 0004-783X; AUFTA

A802; A911; 1 - Crushers - Applications; Limestone - Crushing and Grinding; Grinding Mills; Energy Requirements; Double-Roll Crusher

Treat: A (Applications)

In 1966, a WMG double-roll crusher 16 "multiplied by" 12.5 was put into operation in the crushing plant of the limeworks Otterbein-Mues. Up to the present time, throughput a period of almost 20 years, this crusher has comminuted troublefree and without any problem more than 10 million tons of limestone. The rate of wear and tear was approximately 0.039 g/t resulting in wear costs of 0.33 dpf/t. The crusher will be described in detail. (Author abstract) in English and German.

3113 Vesely, M., Fernandez, O., "Crusher for Critical Size Material at Los Bronce's Semiautogenous Grinding Plant, Chile"; Minerals and Metallurgical Processing, Vol. 3, No. 2, 1986, pp. 104-108

3119 Lewinski, J., Mazela, A., "Analysis of the Impact of a Single Particle on the Hammer of a Hammer Crusher / Analyse des Stosses eines Einzelpartikles gegen den Hammer von Hammerbrechern"; Aufbereit Tech., Vol. 26, No. 10, Oct. 1985, pp. 605-610; 4 Refs.; ISSN 0004-783Z; AUFTA

A533; A931; A921; 1 - Crushers; Dynamics - Analysis; Mathematical Models

Treat: T (Theoretical); X (Experimental)

A theoretical and experimental analysis was made of the impact of a single rock particle on the hammer of a hammer crusher. The experiments were carried out in a model hammer crusher, with the phenomena being recorded by a high-speed camera. The experiments confirmed the theoretical results, which can be used as a basis in the design of hammers. The most important conclusion was that in the hammer crushers which use only the impact effect, the deflection angle of the hammer is very small (Edited author abstract) in German and English.

3120 Thues, H.W., "Fully Mobile Large Crushing Plant/ Eine Vollmobile Grossbrechanlage"; Aufbereit Tech., Vol. 26, No. 10, Oct. 1985, pp. 577-581; ISSN 0004-783X; AUFTA

A533; A505; 1 - Crushers - Design; Rock Products Plants

The largest mobile crushing plant on tires in the world started oeprations at the end of 1984. The plant is in operation in a quarry of one of the largest American suppliers of roadbuilding material and, due to its own mobility, makes the usual expensive truck transport of the material unnecessary. The plant, built by Krupp Industrietechnik GMBH, is absolutely unique worldwide. The largest pneumatic-tire chassis every built, with four sets of double wheels, was chosen as the plant travel mechanism. The wheels have a diameter of more than 3000 mm each, and each wheel is driven by a hydraulic motor with subsequent planetary gear. In German and English.

3124 Michard, Don, (Pit & Quarry, Chicago, Il, USA), "Crushers Solve Reduction Problems", Pit Quarry, Vol. 78, No. 9, Mar. 1986, pp. 32-34; ISSN 0032-0293; PIQUA

A412; A402; 1 - Crushed Stone Plants - Missouri; Crushers; Crushing and Grinding; United States; Canada

Treat: G (General Review)

In this review, producers, manufacturers, and suppliers report recent equipment developments. The projects covered included aggregates process in the United States and Canada.

3125 Sawan, Sam (Rexnord Inc.), "Advances in Crushing", Pit Quarry, Vol. 78, No. 9, March 1986, pp. 42-44, 46-47; ISSN 0032-0293; PIQUA

A533; A913; 1 - Crushing and Grinding; Productivity; Cone Crushers

Treat: G (General Review)

The article is a discussion of how productivity can be increased and operations simplified in crushing. The emphasis is on cone crusher design and operation.

3145 Anon., "Breakthrough in Impact Crushing"; Quarry Manage., Vol. 13, No. 3, March 1986, p. 43; QUMAE

A502; 1 - Quarries and Quarrying - Crushing and Grinding; Crushers - Design; Impact Crushing; Impact Technology Ltd.; Vertical Shaft Impact Crusher

Treat: G (General Review)

The novel feature of impact technology's new crusher is their method of feeding the machine through its so-called 'breakring'. This rotating feed tube has a braking effect on the downward movement of incoming the lowest layer of material emerges from the breakring in a shallow stream to pass through the impeller chamber which has the same rotational velocity. This chamber imparts an acceleration to the stone which flies outwards at 180 ft/s to the anvils which line the inner walls of the annular impact chamber. Stone strikes the anvils clearly at 90 "degree" to give maximum stone-on-metal impact.

3206 Anon., "Bardon Hill Uprate Primary Crusher"; Quarry Manage., Vol. 13, No. 7, July 1986, pp. 43, 46; QUMAE

A533; A502; A412; 1 - Crushers; Quarries and Quarrying - England; Crushed Stone Plants

Treat: G (General Review)

The Bardon Hill Group gyratory at Leicestershire Granite Quarry is described. Dry stone processing produces an annual total of 1.5 million tons of concrete aggregate, rail ballast, sub-base material, chippings and aggregates for coating.

3214 Robertson, Joseph L., "New Crushers Improve Flow"; Rock Prod., Vol. 89, No. 9, Sep. 1986, pp. 44-47; ISSN 0035-7464; ROPRA

A412; 1 - Crushed Stone Plants - Equipment; Crushers - Efficiency

Treat: G (General Review)

The installation of three new crushers led to the replacement of other major processing equipment items at the Angell Boros Inc. operation near Portland, Que. The new equipment allowed a greatly-improved material-flow pattern and provided the capability to produce a line of asphalt aggregates that could not be produced with the company's old equipment. The key to the more-efficient material-flow pattern is in the primary section. By making the primary section semi-portable, the section is now located within 100 ft of the working

face, moving as mining progresses. Formerly, the primary crusher was fed by a haul truck shuttling back and forth from the muck pile to the crusher, a distance of approximately 300 yd. By eliminating the haul truck operating and maintenance expenses, the company has saved about ".25 a Cu yd in production costs and also increased the plant output by 50P.

3215 Smith, Virgil W., Robertson, Joseph L. (Dolese Brothers Co.), "User-Made Crusher Raises Output"; Rock Prod., Vol. 89, No. 8, Aug. 1986, pp. 28-32; ISSN 0035-7464; ROPRA

A533; A412; A692; A502; A691; 1 - Crushers - Design; Crushed Stone Plants - Equipment; Conveyors; Quarries and Quarrying - Crushing and Grinding; Industrial Trucks; Mobile Feeder Section; Haul Trucks; Surge Reclaim System

Treat: G (General Review); X (Experimental)

The homemade two-section primary crushing system which consists of a mobile feeder section, a mobile crushing unit and a conveyor system, is designed to handle stone from one section to another without the aid of mechanical sections. A number of features were added to this new installation aside from the feeding and crushing units. A new screen tower, two 600-ton loadout bins added over the railroad tracks to load out crusher-run material, an improved surge reclaim system, and an increase in the plant's live load in the surge pile from 7,000 tons to 35,000 tons. The six criteria established which cover the design and construction of the system are discussed.

3216 Robertson, Joseph L., "Designing a More Movable Plant"; Roc Prod., Vol. 89, No. 8, Aug. 1986, pp. 40-42; ISSN 0035-7464; ROPRA

A412; A505; A632; A533; A605; 1 - Crushed Stone Plants - Portable; Sand and Gravel Plants - Hydraulic Equipment; Crushers; Screens and Sieves; Mobilization Costs; Cost Reduction Program

Treat: G (General Review)

A mobilization cost reduction program which includes 3 basic principles of good portable plant design is discussed. The 3 principles are: setting gross weight limits and axle weight limits of building equipment; use of innovation in plant design; and flexibility and

foresight in design planning. Several examples are described to explain these three principles.

3217 Robertson, Joseph L., "Self-Made Plant is Full of Ideas";, Rock Prod., Vol. 89, No. 8, Aug. 1986, pp. 33-36, 56; ISSN 0035-7464; ROPRA

A505; A412; A483; A502; A605; 1 - Sand and Gravel Plants - Portable; Crushed Stone Plants - Pumps; Sand and Gravel - Dredging; Screens and Sieves; Cutter head; Stinger Design; User-Designed Plant

Treat: G (General Review); X (Experimental)

A Nebraska sand and gravel plant incorporated used equipment and user-design to build a portable plant capable of producing 195 tph of concrete sand and road gravel. The main reason for the portability is that the plant should be close to the dredge in order to avoid booster pumps and save on energy costs to run the pump and on pump repairs. The equipment moved from the old sand pit included the dredge, a large rotary screen, 44-in sand dewatering screw and the log washer. The rotary screen and matching unit were rebuilt to handle the pit material. Another smaller rotary screen was constructed and a 6-cell rising current sand classifier was assembled from a pair of used steel loadout bins and purchased valve components. The construction of the cutterhead and an 86-ft long stinger or suction pipe for the dredge was the main part of the project.

3218 Robertson, Joseph L., "In-Pit Crusher Saves Haul Costs"; Rock Prod., Vol. 89, No. 8, Aug. 1986, pp. 52-54; ISSN 0035-7464; ROPRA

A533; A412; A691; A502; 1 - Crushers; Crushed Stone Plants - Equipment; Industrial Trucks; Quarries and Quarrying - Screening; In-Pit Gyratory Crusher; Haul Trucks

Treat: G (General Review)

A new primary section has eliminated two crushers and two trucks by using an in-pit gyratory crusher to crush shot rock for the D.M. Stoltzfus Plant near Elk Mills, MD. It also brought about a revision in the material flow through the primary section that increased potential production capacity by 25P. The shorter haul resulted from setting the crusher on the pit floor and filling the receiving hopper from a point about midway

to the top. In the earlier system, the haul trucks had to bring the stone all the way up to the quarry rim and dump it in one of three crushers positioned along the rim.

3219 Anon., "Comminution by Roller Presses Saves Energy"; Rock Prod., Vol. 89, No. 7, July 1986, pp. 32-33; ISSN 0035-7464; ROPRA

A412; A525; 1 - Crushing and Grinding - Energy Conservation; Crushers - Design; High-Pressure Grinding Rollers

Treat: G (General Review)

A new comminuting process can save energy in grinding hard brittle materials, such as cement clinker, granulated slag, limestone and quartzite sand. This process subjects the materials to high pressure between two rollers. Although this comminution equipment and technique closely resembles a roll crusher, the degree of comminution achieved with the high-pressure grinding rolls is greater, even after only a single pass. Compared to a tube mill, the high-pressure grinding roll needs only 25% to 50% of the specific energy for raw grinding of a material.

3220 Anon., "In-Pit Crushing and Conveyor Systems Improve Productivity and Economy", Rock Prod., Vol. 89, No. 7, July 1986, pp. 36-39; ISSN 0035-7464; ROPRA

A502; A911; 1 - Quarries and Quarrying - Crushing and Grinding; Crushing and Grinding - Costs; Crushers and Efficiency

Treat: E (Economic/Cost Data/Market Survey); G (General Review)

A number of types of mobile and semimobile in-pit crushing plants are compared with regard to efficiency and conditions of use. In addition, the conditions under which the use of a continuous conveying system and in-pit crushing system can be profitable are considered.

3221 Huhta, Richard S., "Roll Crushing: Hot New Topic"; Rock Prod., Vol. 89, No. 7, July 1986, pp. 44-45; ISSN 0035-7464; ROPRA

A412; A525; 1 - Crushing and Grinding - Energy Conservation; Crushers - Design; High-Pressure Grinding Rollers

Treat: G (General Review)

Two papers on roll crushing, given at an IEEE meeting in Salt Lake City in May of this year, are reviewed. The two speakers reported that the roll presses significantly crush the clinker particles, producing fractures througout the structure of the resulting particles, and that the new comminution method does clearly result in substantial energy savings for cement producers. One speaker reported energy savings of 20p at a slag grinding facility, and production increases of between 20p and 40p at cement installations. The other speaker reported that grinding rolls is 2 to 3.5 times better than in ball mills. In addition, he reported energy savings amount to 3 to 6 kwh/mt or 10p to 20 p when pregrinding in high-pressure grinding rolls.

3227 Althoff, H., Clark, R.D. (O&K Orenstein & Koppel Canada Ltd., Div. Min. Equipment & Mat. Handling, Dundas Ontario, Canada), "In-Pit Crushing and Conveying Reduces Haulage Costs"; CIM Bulletin, Vol. 79, No. 892, 1986, pp. 59-61; Ref: 000

1986 (C) GRINDING

(i) Rod and Ball Milling

2911 Kuhlmann, K., Ellerbrock, H.G. (Forschunginst Zementind, Dusseldorf, Fed. Rep. Ger.), "Adjustment and Operation of Ball Mills for Cement Grinding"; Zement-Kalk-Gips, Vol. 38, No. 12, 1985, pp. 720-722; Ref: 000

2936 Mieczaniec, J.G., "Performance of the Lornex 34-foot Variable Speed Mill"; Can. Min. Metall. Bull. (Oct. 1985), Vol. 78, No. 882, pp. 43-47; ISSN 0317-0926

41; Ball Crushers, Design; Grinding (Comminution); Economics

When economic studies revealed that the optimum expansion for Lornex Mining Corporation in the Highland Valley of British Columbia (Canada) was to increase plant throuhput by 85%, a grinding mill larger than the existing 32 ft. dia. mills was needed. It was decided to use a twin dc motor drive system with variable speed for a 34 ft. mill. A period of 18 months was used to compare the original 32 ft. to the 34 ft. mill. This

period showed an average 5.68 kWh/ton for the 34 ft. mill vs. 5.842 average kWh/ton for the 32 ft. mill. The variable speed twin dc drive has given Lornex the flexibility to tune the mill speed for best throughput. It is also used for maintenance, equipment breakdown for kickout, unusual soft ore conditions or occasionally to bring mill loading into balance, on the down side, the mill availability could be better, more flexibile mill inching and better commutation by the motors would increase availability.

2942 Ackle, W., "State of Development and Operating Experience with Planetary Gears for Driving Large Tube Mills"; Zement-Kalk-Gips, Vol. 39, No. 1, 1986, pp. 39-46; Ref: 000

3000 Price, A., "Increasing Grinding Efficiency"; Int. Min. Vol. 2, No. 12, Dec. 1985, pp. 25-27; ISSN 0043-8707

41; Ball Milling; Grinding (Comminution); Ball Mills; Service Life; Wear; Efficiency

Factors affecting grinding ball wear and efficiency and factors contributing to mill efficiency and performance are discussed. The hardest balls are not necessarily the most effective, and equations such as the bond currently in use tend to recommend too small a size. This results in overgrind and reduced throughput. Sixteen factors are listed that affect ball performance. Under "mill efficiency" the roles of mill capacity, size of feed, hardness of feed, ball charge-size and amount, mill system, mill power, critical speed and moisture content are summarized.

3009 Bogdanov, V.S. (Belgorod Technology Inst. of Building Materials, Belgorod, USSR), "Energy Exchange Devices for Drum Ball Mills"; Glass Ceram., Vol. 42, No. 5-6, May-June 1985, pp. 279-282; 5 Refs.; ISSN 0017-100X; GLCEA

A802; A414; A412; A601; 1 - Grinding Mills - Ball Milling; Building Materials; Drum Ball Mills

Treat: T (Theoretical); X (Experimental)

A new design is proposed for internal mill device which redistribute the energy balance of the capacity and which we term energy-exchange devices. The authors propose an interchamber dividing section to be installed at an incline to the longitudinal axis of the mill drum. Equations are developed which are suitable for calculating all the main parameters of the mills

with the sloping partitions. The use of the sloping interchamber partitions in ball mills in the ceramics and also in the glass industry ensures a marked saving in power and material resources.

3101 Anon., "What Ball Size Should be Used in Large Mills"; E&MJ-Engineering and Mining Journal, Vol. 187, No. 6, 1986, p. 79; Ref: 000

3121 Reddy, P.S.R., Sastri, S.R.S., Naraismhan, K.S., "Effect of the Feed Rate on the Grain Size Distribution of the Ground Product During Open-Circuit Grinding / Einfluss der auf Gaberate auf die Korngroessenverteilung des Mahlproduktes bei der Mahlung in Offenem Kreislauf"; Aufbereit Tech., Vol. 25, No. 10, Oct. 1985, pp. 591-593; ISSN 0004-783X; AUFTA

A533; 1 - Crushing and Grinding - Efficiency; Grinding Mills - Ball Millings

Treat: X (Experimental)

Simple linear relationships are found to exist between the product size, designated by the 80% passing size, and the mill feed rate in the case of open-circuit overflow type ball mills for the grinding of chromite ore. The results are additionally influenced by the diameter of the balls: the smaller the ball diameter and the broader its distribution, the more distinct is the influence of the feed rate on the product size (edited author abstract) in German and English.

3140 Fuerstenau, D.W., Abouzeid, A.-Z.M., Swaroop, S.H.R. (Univ. of California, Berkeley, CA, USA), "Material Transport in Ball Mills, Effect of Discharge-End Design"; Powder Technol., Vol. 46, No. 2-3, April-May 1986, pp. 273-279; 12 refs; ISSN 0032-5910; POTEB

A802; A631; A921; 1 - Grinding Mills - Ball Milling; Flow of Fluids - Mathematical Models; Grate-Discharge Ball Mill; Overflow-Discharge; Peclet Number; Mechanistic Model

Treat: T (Theoretical); X (Experimental)

The results of a detailed study on material flow through a ball mill versus an overflow-discharge ball mill are presented to emphasize the effect of discharge-end design on mill transport characteristics. The effect of feed rate to the mill, mill rotational speed and ball load on the residence time distribution

of the flow regime, the peclet number and the material hold-up are discussed. The observed transport characteristics of the two types of mill are qualitatively interpreted in terms of a mechanistic model for particle flow through the mills. (Edited author abstract).

3207 Weit, H., Schwedes, J. (Tech. Univ. Burnswick, Inst. Mech. Verfahrenstech Volkmaroder Str 4-5 D3300 Brunswick, Fed. Rep. Ger.), "Scale-up of Agitator Ball Mills"; Chemie Ingenieur Technik., Vol. 58, No. 10, 1986, pp. 818-819; Ref: 000

3224 Honma, Torajiro, Juriyama, Masafumi, Kanda, Yoshiteru (Jamagata Unv., Jpn.), "Ball Mill Grinding Using Centrifugal Force"; Nippon Kogyo Kaisi, Vol. 102, No. 1179, May 1986, pp. 301-304; 12 Refs; ISSN 0369-4194; NIKKA

A533; A482; A812; 1 - Grinding Mills - Ball Milling; Feldspare - Crushing and Grinding; Glass-Crushing and Grinding; Centrifugal Force Grinding; Specific Surface Area; Size Distribution

Treat: T (Theoretical); X (Experimental)

Grinding experiments were made on a new type of ball mill operated under centrifugal force. Feldspar, quartz and soda glass were utilized to examine the specific surface area and size distribution as a function of operating conditions. Size distributions of products are represented by Rosin-Rammler equation. (Edited author abstract). In Japanese.

1986 (C) GRINDING (ii) Autogenous and Semi-Autogenous Grinding

3100 Barratt, D.J., Allan, M.J. (Wright Engineers Ltd., Vancouver, BC, CAN), "Testing for Autogenous and Semiautogenous Grinding: A Designer's Point of View"; Miner. Metall. Process., Vol. 3, No. 2, May 1986, pp. 65-74; 12 Refs; ISSN 0747-9182; MMPRE

A533; A802; A423; A911; 1 - Grinding Mills - Testing; Crushing and Grinding - Costs; Ore Treatment - Crushing and Grinding; Semiautogenous Grinding

Treat: A (Applications); E (Economic/Cost Data/Market Survey)

This paper reviews current testing methods for sizing autogenous and semiautogenous mills in the North

American context with comments on the necessity for test work and requirements for different circuits and equipment selection. The economics of testing and the value received are discussed.

3109 Bassarear, J.H., Thomas, P.F. (Fluor Engineers' Inc., Redwood City, CA, USA), "Variable Speed Drives for Semiautogenous Mills"; Miner. Metall. Process., Vol. 3, No. 2, May 1986, pp. 136-144; 14 Refs; ISSN 0747-9182; MMPRE

A533; A705; 1 - Copper Ore Treatment - Crushing and Grinding; Grinding Mills - Electric Drive; Electrive Drive - Variable Speed; Semiautogenous Mills; Variable Speed Drive; Porphyry Copper

Treat: G (General Review)

This paper provides a base case using standard accepted technology of two wound rotor single speed 4476 kW (6000 HP) motors to drive the primary SAG (Semiautogenous) mills of a hypothetical 36,364 t/d typical porphyry copper mill. One other fixed speed drive is described and five variable speed drive configurations are reviewed. Capital costs for the entire grinding circuit, from crusher product to flotation feed, were developed for the base case and each of the alternatives. A technical evaluation comparing the advantages and disadvantages of each drive is presented. (Edited author abstract).

3110 Bymark, J.V,. Von Bitter, R.W. (Pickands Mather Services Inc., Hibbing, MN, USA), "Autogenous Grinding at Hibbing Taconite Co."; Miner. Metall. Process, Vol. 3, No. 2, May 1986, pp. 87-91; ISSN 0747-9182; MMPRE

A533; 1 - Iron Ore Treatment - Crushing and Grinding; Grinding Mills; Autogenous Grinding; Hibbing Taconite Co.; Mill Liner

Treat: A (Applications)

The Hibbing Taconite Co. concentrator flowsheet, which is noted for its simplicity, uses single-stage autogenous grinding coupled with two stages of magnetic separation and two stages of size classification to produce a magnetite concentrate. This paper discusses the pilot-plant development of single stage grinding, the commercial mill grinding performance, and mill linear development. Process innovation discussions include process control computer implementation, size classification improvements, mill speed changes,

magnetic separator improvements, and quality control innovations. (Author abstract).

3111 Dailey, W.C., "Wet Semiautogenous Grinding Mills at National Steel Pellet Co."; Mineral and Metallurgical Processing, Vol. 3, No. 2, 1986, pp. 92-95

3229 Austin, L.G., Barahona, C.A., Weymont, N.P.; Suryanarayanan, K. "Improved Simulation Model for Semi-Autogenous Grinding"; Powder Technol., Vol. 47, No. 3, Aug. 1986, pp. 265-283; 16 Refs; ISSN 0032-5910; POTEB

A533; A802; A921; A804; 1 - Crushing and Grinding - Mathematical Models; Grinding Mills - Ball Milling; Powders; Semi-Autogenous Grinding; Steady-State Simulation Models; Fully-Mixed Reactor; Autogenous Self-Breakage

Treat: T (Theoretical); X (Experimental)

The model originally proposed by Austin et al. has been modified in the light of further investigation of the breakage laws in SAG (Semi-autogenous grinding) milling. The model uses a fully-mixed reactor for short l/d mills and calculates the breakage of small particles by the nipping action of balls and pebbles. Simulation results are compared with results from tests in a 1.8 M diameter continuous pilot-scale SAG mill. Future work is discussed. (Edited author abstract).

1986 (C) GRINDING iii) Tower and Other Milling Methods

2906 Herbell, Thomas P., Glasgow, Thomas K., Orth, Norman W. (NASA, Lewis Research Cent., Cleveland, OH, USA), "Demonstration of a Silicon Nitride Attrition Mill for Production of Fine Pure Si and Si/3N/4 Powders"; Am. Ceram. Soc. Bull., Vol. 63, No. 9, Sep. 1984, Jpn-US Ceram. Soc. Small Conf., Tokyo, Jpn., May 17, 1984, pp. 1176-1178; 7 Refs.; ISSN 0002-7812; ACSBA

A812; 1 - Refractory Materials - Silicon Nitride; ceramic Materials - Crushing and Grinding; Ball Milling; Reaction-Bonding; Agglomerates; Uniform Particles

Treat: A (Applications); X (Experimental)

To avoid metallic impurities normally introduced by milling ceramic powders in coventional steel hardware, an attrition mill (high-energy stirred ball mill) was constructed with the wearing parts (mill body, stirring

arms, and media) made from silicon nitride. Commercial silicon and Si/3n/4 powders were milled to fine uniform particles with only minimal contamination. (Edited author abstract).

2910 Scheucher, F.J., "Optimization of Tube Mill Power-Consumption with Voest-Alpine Grooved Liner Plates"; Zement-Kalk-Gips, Vol. 38, No. 12, 1985, pp. 732-733; Ref: 000

2912 Hirt, M., "Experience with the Design of Bevel-Wheel Planetary Gears for Roller Mills"; Zement-Kalk-Gips, Vol. 38, No. 12, 1985, pp. 712-714; Ref: 000

2913 Tanaka, T., Kohama, H., "Operating Experience with an 8000 kW Tube Mill for Cement Grinding"; Zement-Kalk-Gips, Vol. 38, No. 12, 1985, pp. 717-719; Ref: 000

2914 Schneider, L.T., Lohnherr, L. "Roller Mills for High Capacities and Difficult Material"; Zement-Kalk-Gips, Vol. 38, No.12, 1985, pp. 705-708; Ref: 000

2915 Mustro, R.L., Dunn, M.R., "Effect of Table Speed and Geometry on Roller Mill Performance"; Zement-Kalk-Gips, Vol. 38, No. 12, 1985, pp. 709-711; Ref: 000

2929 Radharkrishnan, V., Achyutha, B.T. (Indian Inst. Technol., Dept. Mech. Engn., Madras 600036, Tamil, Nadu, India), "A Method for Reducing the Corner Wear in Plunge Grinding"; Proceedings of the Institution of Mechanical Engineers, Part B - Management and Engineering Manufacture, Vol. 200, No.1, 1986, pp. 19-26; Ref: 000

3036 Skvortsov, V.R., "Investigation of Dynamics, Control, and Protection of Roller-Mill Grinding Mechanism"; Sov. Energy Technol., No. 3, 1985, pp. 17-24; 7 Refs; SETED

A524; A533; 1 - Coal Pulverizers - Reliability; Coal - Crushing and Grinding; Roller Mills; Grinding Mechanism

Treat: A (Applications); X (Experimental)

Half-speed bowl mills, or ring-roll (roller) mills, have been playing an increasingly prominent role in the inventory of Soviet-fabricated coal pulverizing equipment. The present article addresses two aspects of the problem of mill reliability. Under stationary conditions, the force applied to the roll, and all relevant power and kinematic factors (force, pressure, stress, strain, etc.) in any component stay close to ratings on the average. There can be some slow changes

occurring in response and to variation of the height of the coal bed on the table, and random high-frequency vibrations of slight amplitude, caused by nonuniformity in the coal piled on as a deformably medium.

3039 Slatinka, L. (Brown Boveri Co. Ltd., Div. Ind. Equipment, Dattwil, Switzerland), "Gearless Drive for an Ore Grinding Mill"; Brown Boveri Review, Vol. 73, No.4, 1986, pp. 164-166; Ref: 005

3136 Slatinka, L. (Brown, Boveri & Co., Dattwil, Switz), "Gearless Drive for an Ore Grinding Mill"; Brown Boveri Rev, Vol. 73, No.4, Apr. 1986, pp. 164-166; 5 Refs; ISSN 0007-2486; BRBOA

A706; A531; A604; 1 - Electric Drive - Applications; Ore Treatment - Equipment; Milling; Electric Motors - Applications; Gearless Mill Drives; Ring Motors

Treat: G (General Review)

The installation of gearless mill drives in large ore grinding mills not only precludes the wear which exists with geared drives, but also permits the grinding process to be optimized by variation of the speed. Given these facts, it is hardly surprising that more and more mill operators are showing an interest in such drives. By mid-1985, Brown Boveri had commissioned their twenty-fourth gearless mill drive. This order- from a mill operator in Papua New Guinea - differs from earlier orders in that the drive is to be used in a wet grinding process. (Author abstract)

3223 Shaw, George (Met.-Chem. Canada Inc., Kudremukh, India), "Wet Clutch, A New Approach for Large Grinding Mill Drives"; J. Mines Met. Fuels, Vol. 33, No. 11-12, Nov - Dec 1985, p. 489-496; ISSN 0033-2755; JMMFA

A533; A602; A632; A705; 1 - Grinding Mills - Drives; Iron Ore Treatment - India; Wet Clutch

Treat: X (Experimental)

India's largest mining and mineral beneficiation facility, the Kudremukh Iron Ore project, is located at an altitude of 800 M (2600) in the western Ghats area of the state of Karnataka, 68 km (42 miles) from the Arabian sea port of Mangalore. The discussion demonstrates the feasbility of using a hydroviscous wet clutch mechanism within the drive system of a large grinding mill.

1986 (C) Grinding (iv) Wear and Liners

2952 Iwasaki, I., Riemer, S.C., Orlich, J.N., Natarajan, K.A. (Miner. Resour. Res. Cent., Univ. Minnesota, Minneapolis, MN, USA, 55455 (US)); "Corrosive and Abrasive Wear in Ore Grinding"; Wear, Vol. 103, No. 3, 1985, pp. 253-267; ISSN 0043-1648; WEARA

CA154001; Grinding Ball Wear Abrasive Corrosion; Ore Grinding Ball Wear

Ore Treatment; 67-56-1; 107-21-1; 1310-50-5; 11109-50-5; 12725-36-9; 97696-63-4

3004 Motz, J. (Nordberg, Crushing & Grinding Projects, USA), "Crusher Liner Design and Wear Analysis"; Quarry Manage., Vol. 12, No. 9, Sep. 1985, pp. 641-642, 645; QUMAE

A533; A913; A911; 1 - Crushers - Wear; Maintenance - Costs; Productivity; Liners Design; Symons Cone Crusher; Gyradisc

Treat: G (General Review)

The paper provides methods of analyzing crusher performance with respect to crusher liner design and its effect on productivity and maintenance cost. In addition, a review of the recent developments pertaining to the design and operating practices relating to the Symons cone crusher is made. Many of these developments can be incorporated into existing units to permit increased productivity coupled with a reduction in maintenance cost and downtime.

3014 Gangopadhyay, A.K., Moore, J.J. (Univ. of Minnesota, Mineral Resources Research Cent., Minneapolis, MN, USA), "Assessment of Wear Mechanisms in Grinding Media"; Miner. Metall. Process., Vol. 2, No. 3, Aug. 1985, pp. 145-151; 11 refs.; MMPRE

A533; A421; 1 - Ore Treatment - Crushing and Grinding; Grinding Mills - Ball Milling; Wear of Materials; Grinding Media; Scanning Electron Microscopy; Grinding Ball Materials

Treat: T (Theoretical); X (Experimental)

The effect of grinding media composition, mineral type, and slurry environment on the wear rate of various grinding media (balls) are discussed. Sufficient wear

data have been obtained and correlated. Modes of wear were determined from examination of the ball surfaces using scanning electron microscopy. Five modes of wear have been identified to be operative under certain slurry conditions for the various ball compositions studied. (Author abstract)

3103 Skorupa, J., "Evaluations of Various Ball-Tube Linear Materials for Coal Grinding"; S. Afr. Mech. Eng., Apr. 1986, Vol. 36, No. 4, pp. 112-113, 115, 117-119; ISSN 0038-2442

31; Coal; Grinding (Comminution); Ball Mills; Liners, Materials Substitution; Wear Resistance; Grinding Abrasion; Manganese Steels, Mechanical Properties; White Iron, Mechanical Properties; Chromium Molybdenum Steels, Mechanical Properties

The use of indigenous lower grades of highly abrasive coal at the newer Escom power stations has necessitated switching back from vertical-spindle mills to the more wear-resistant ball-tube mills. To exend the period between successive liner changes in the ball-tube mills, an austenitic manganese steel, a pearlitic high carbon Cr/Mo steel, an austenitic white high chrome iron and six martensitic white cast chrome irons were evaluated for use as liners. The properties investigated were: micro- and macro-hardness, using Vickers, Rockwell or Brinell equipment; carbide volume fraction of white cast chrome iron, using optical micrographs and computerized image analysis; carbide size and distributions, using quantitative image analysis; retained austenite, by X-ray diffraction; abrasion tests (low stress and gouging). It was concluded that the austenitic and two martensitic white cast chrome irons were the best and the Mn and Cr/Mo steels the least suitable.

3137 Vermuelen, L.A., Howat, D.D. (Council for Mineral Technology, Randburg, S. Afr.), "Fluctuations in the Slip of the Grinding Charge in Rotary Mills with Smooth Liners"; Int. J. Miner. Process, Vol. 16, No. 3-4, March 1986, pp. 153-168; 5 Refs.; ISSN 0301-7516; IJMPB

A533; A603; A943; 1 - Grinding Mills; Mechanical Variables Measurement - Velocity; Grinding Charge Slip; Angular Position; Smooth Liners

Treat: A (Applications); T (Theoretical)

A study is reported of the motions of grinding elements that were in contact with the smooth liner of an

experimental rotary mill. Their speeds were measured while they were being transported from beneath the toe of the charge upwards to the neighbourhood of their departure from the liner. Even though the liner was moving in uniform circular motion, large fluctuations (of the order of 30%) in the speed of these particles were found to occur while they were in contact with the liner. It is shown quantitatively that corresponding fluctuations in pressure, which are developed in the grinding charge, are responsible for the large and apparently erratic fluctuations in velocity. (Author abstract)

3141 Vermuelen, L.A. (Counc. Miner. Technol., Randburg, S. Afr., 2125 (ZA)), "Ball Wear and Ball Size Distributions in Tumbling Ball Mills. Comments"; Powder Technol., Vol. 46, No. 2-3, 1986, pp. 281-285; ISSN 0032-5910; POTEB

CA147006; Grinding Ball Wear Polemic; Tumbling Ball Mill Wear Polemic

Wear; Size Reduction

3144 Vermuelen, L.A., Howat, D.D. (Council Mineral Technol. Mintex, Private Bag X3015, Transvaal 21 25 South Africa, Univ. Mitwarersrand, Johannesburg 2001 South Africa), "Abrasive and Impactive Wear of Grinding Balls in Rotary Mills"; Journal of the South African Institute of Mining and Metallurgy, Vol. 86, No. 4, 1986, pp. 113-124; Ref: 019

3147 Austin, L.G., Barahona, C.A., Menacho, J.M. (Pennsylvania State Univ., University Partk, PA, USA), "Fast and Slow Chipping Fracture and Abrasion in Autogenous Grinding"; Powder Technol., Vol. 46, No. 1, Mar. 1986, pp. 81-87; 13 Refs.; ISSN 0032-5910; POTEB

A533; A802; 1 - Grinding Mills - Ball Milling; Ore Treatment - Crushing and Grinding; Chipping Fracture; Abrasion; Autogenous Grinding

Treat: T (Theoretical); X (Experimental)

A theoretical analysis of the unsteady-state batch abrasion of feed material within a screen interval shows that abrasion will not lead to first order breakage kinetics. The differential equation for combined first order fracture breakage plus abrasion is solved for a rectangular feed distribution within the feed size interval. The solution leads to apparent first order breakage kinetics, provided that abrasion

rate is relatively small compared with fracture rate, and the equation is given for the overall specific rate of breakage. Experiments show that the kinetics of batch autogenous grinding can be treated as some fraction of a fast fracture rate plus a slower abrasion rate and the remaining fraction as a slow fracture rate plus a slower abrasion rate. The respective constants depend on cushioning due to fine material in the charge.

3148 Menacho, J.M. (Min. Metall. Res. Cent. Chile, Chile (CL)), "A Contribution to Ball Wear and Ball Size Distribution in Tumbling Mills by L.A. Vermuelen. Comments"; Powder Technol., Vol. 47, No. 1, 1986, pp. 97-99; ISSN 0032-5910; POTEB

CA148003; Ball Wear Tumbling Mill Polemic; Mill Ball Size Distribution Polemic

Wear; Size Reduction Apparatus

3232 Venkataraman, K.S., Fuerstenau, D.W. (Univ. of California, Berkeley, CA, USA), "Effect of Lifter Shape and Configuration on Material Transport Part I: In Rotating Drums"; Powder Technol., Vol. 46, No. 1, Mar. 1986, pp. 23-32; 14 Refs.; ISSN 0032-5910; POTEB

A533; A921; 1 - Grinding Mills; Ore Treatment - Crushing and Grinding; Iron Ore Treatment - Crushing and Grinding; Mathematical Models; Rotating Drums; Spiralling; Liners; Comminution; Energy Efficiency

Treat; T (Theoretical); X (Experimental)

This paper presents the steady-state transport behaviour of rotating drums fitted with conventional bar lifters and forward-and reverse-spiralling square lifters when monosize hematite was fed through the devices. The steady-state hold-up in the drum fitted with the forward-spiralling square lifters was less. However, the dimensionless residence time distributions (RTDS) were independent of the direction of spiralling. Overall, the degree of mixing was greater for drums fitted with square lifters. Forward-spiralling configurations showed a greater degree of mixing. RTDS are discussed in terms of single-parameter models and mechanistic explanations for the observations are offered. (Edited author abstract)

1986 (D) CLASSIFICATION

2917 Bahr, A., Dwajadi, G.H., Klingebiel, S. (Tech. Univ. Clausthal, Inst. Aufbereitung & Veredelung, Flotat. & Chem. Verfahren Abt. D-3392. Clausthal, Zellerfe, Fed. Rep. Ger.), "Classifying and Sorting Effects of a Hydrocylone"; Erzmetall, Vol. 38, No. 11, 1985, pp. 536-543; Ref: 000

3017 Pillai, K.J., Spottiswood, D.J., Bull, W.R., Kelly, E.G. (Colorado Sch. Mines, Golden CO 80401), "A Preliminary Model of a Water-Only Cyclone and Its Application to Product Quality-Control"; In: Norrie, A.W., Turner, D.R., Automation for Mineral Resource Development, 1986, pp. 227-233; Ref: 000; pub: Pergamon Press Ltd, Headington Hill Hall, Oxford OX3 OBW, UK

Symp. on Automation for Mineral Resource Development, Held: Brisbane, Australia, 85/7/9-11

IFAC Proceedings Series

LC: 85-21844 ISBN: 0-08-031663-8

3029 Anon., "New Screen Deck Stops Sticking, Lifts Efficiency";, E&MJ- Engineering and Mining Journal, Vol. 187, No. 5, 1986, pp. 53; Ref: 000

3104 Brozek, M., Pilch, W., Polanski, W., Siwiec, A., (Inst. Miner. Process. Util., Univ. Min. Metall., Kracow, Pol, 30-059 (PL)), "A New Type of Drum-Plate Magnetic Separator for Dry Fine Ores Processing"; Congr. Int. Mineralurgie, (C.R.), 15th, Vol. 1, 1985, pp. 435-45; 55CYA; Pub: Gedim, St. Etienne, Fr.

CA154001; Quartz Magentite Ilmenite Magnetic Sepn; Ore Fine Dry Magnetic Sepn.

Ore Treatment; Magnetic Field; 14808-60-7; 12168-52-4; 1309-38-2

3231 Beeckmans, J.M; Thielen, S. (University Western Ontario, Fac. Engn. Sci. London N6A 5B9 Ontario Canada), "Performance-Characteristics of the Roller-gap Particle Classifier"; Powder Technology, V48, N2, 1986. P: 181-185 REf: 006.

1986 (E) THEORY, KINETICS, MODELLING AND FRACTURE

2904 Kafarov, V.V., Veroyan, W.A. (Moscow Inst. Chim. - Technol., Moscow, USSR (SU)), "Mathematical Models and Their Application for Optimizing Crushing Processes and Improving Product Quality"; Int. Congr. Chem. Cem., (Proc.), 7th, Vol. 2, 1980, pp. I/29-I/33; 48JWA; Pub: Septima, Paris, Fr.

CA148000; Review Grinding Model Optimization

Process Optimization, Size Reduction

2909 Slanewski, A.W., "Equations for the Motion of the Grinding Media in the Tube Mill"; Zement-Kalk-Gips, Vol. 38, No. 12, 1985, pp. 731-732; Ref: 000

2919 Kanda, Yoshiteru, Hasegawa, Masahiro, Honma, Torajiro, Hashima, Saburo (Jamagata Unv., Faculty of Engineering, Jpn), "Estimation of Work Index from Ball Mill Grindability and Vicker's Hardness Using Beer Bottle Glass as a Standard Sample"; Nippon Kogyo Kaishi, Vol. 101, No. 1169, July 1985, pp. 422-426; 36 Refs; ISSN 0369-4194; NIKKA

A533; A812; A413; 1 - Grinding Mills - Ball Milling; Glass - Grinding; Work Index; Vicker's Hardness; Beer Bottle Glass; Ball Mill Grindability

Treat: T (Theoretical)

Work index proposed by bond is an important factor in designing a grinding process and has been ever used widely. As the measurement procedure of work index is closely defined by Japanese industrial standard, the ball mill employed for measurement must sufficiently satisfy the standard. In this work, using an arbitrary ball mill and beer bottle glass as a standard sample, the estimation of work index was experimentally investigated. It was found that work index could be estimated independently of the ball mill employed by the examination of the zero order increasing rate constant of mass fraction less than a particle size. A new method which is able to estimate work index from only Vicker's hardness of sample has been suggested. (Edited author abstract). In Japanese.

2926 Forssberg, Eric, Zhai, Hongzin (Div. Miner. Process., Lulea Univ. Technol., Lulea, Swed., S-9 41 87 (SE)), "Shape and Liberation Studies on Grinding Products from Autogenous and Conventional Mills Using an Automatic

Image Analyser"; Scand. J. Metall., Vol. 14, No. 6, 1985, pp. 283-288; ISSN 0371-0459; SJMLA
CA154001; Grinding Ore Autogenous Ball Mill; Pyrite Grinding Liberation Image Analysis; Magnetite Grinding Liberation Image Analysis

Ore Treatment; 1309-38-2; 1309-36-0

2930 Peterson, T.W., Scotto, M.V., Sarofim, A.F. (Dep. Chem. Eng., Univ. Arizona, Tucson, AZ, USA, 85721 (US)), "Comparison of Comminution Data with Analytical Solutions of the Fragmentation Equation"; Powder Technol., Vol. 45, No. 1, 1985, pp. 87-93; ISSN 0032-5910; POTEB

CA148003; Comminution Fragmentation Equation

Size Reduction

2940 Leonov, R.E. (SGI, USSR, (SU)), "Statistical Models of the Kinetics of Size Reduction"; IZV. Vyssh. Uchebn. Zaved., Gorn. Zh., No. 10, 1985, pp. 110-116; ISSN 0536-1028; IVUOA

CA154001; Ore Grinding Model Kinetics Mechanism; Iron Ore Grinding Optimization Model

Process Simulation; Ore Treatment; Iron Ores

2943 Rakaev, A.I., Bilenko, L.F., Zadorozhnyi, V.K., Baitarshino, V.R.A. (USSR (SU)), "Kinetics of Ore Grinding in a Rod Mill"; Obogashch. Rud (Leningrad), No. 3, 1985, pp. 5-8; ISSN 0029-7623; OBOGA

CA154001; Ore Grinding Rod Mill Model

Process Simulation; Ore Treatment; Particle Size

2947 Tangsathitkulchai, C., Austin, L.G., "The Effect of Slurry Density on Breakage Parameters of Quartz, Coal and Copper Ore in a Laboratory Ball Mill"; Powder Technol., June 1985, Vol. 42, No. 3, 287-296; ISSN 0032-5910

41; Slurries; Grinding; Copper Ores; Beneficiation; Benefication; Ball Mills

Batch wet grinding of 20 x 30 mesh feeds of quartz and copper ore in a laboratory ball mill gave first-order or non-first breakage of this size depending on conditions, with acceleration of breakage rate occurring for lower slurry density and deceleration at

higher. Small sizes in the slurry appeared to break in a first-order manner, with normalized primary breakage distributions. Breakage of a coal was first order for all sizes. Rates of breakage went through a maximum at 45 vol. % solids for all three materials, but the maximum was most pronounced for coal and least for quartz. Higher slurry densities changes the primary breakage distributions, giving proportionally more fine material. The decrease in overall breakage rates at higher slurry density corresponded to decrease in net mill power, implying a change in the tumbling action in the mill. No physical model is proposed for the variation of breakage rates of the top size, but investigations are continuing. 21 ref.

2955 Barriga, Cristobalina, Morales, Julian, Tirado, Jose L. (Dep. Quim. Inorg., Fac. Cienc., Cordoba, Spain (ES)), "Effect of Grinding on the Kinetics of the Transformation Vaterite-Calcite"; Thermochim. Acta, Vol. 92, 985, pp. 211-214; ISSN 0040-6031; THACA

CA157002; Vaterite Calcite Transformation Grinding

Size Reduction; 13701-58-1; 13397-26-7

2956 Kiser, James D., Herbell, Thomas P., Freedman, Marc R. (Lewis Res. Cent., Natl. Aeronaut. Space Adm., Cleveland, OH, USA, 44135 (US)), "Parametric Evaluation of Ball Milling of Silicon Carbide in Water"; Ceram. Eng. Sci. Proc., Vol. 6, No. 7-8, 1985, pp. 1135-1145; ISSN 0196-6219; CESPD

CA157002; Silicon Carbide Milling

Ceramic Materials and Wares; Size Reduction; 409-21-2

3002 Austin, L.G. (Pennsylvania State Univ., Mineral Processing Section, University Park, PA, USA), "Note on Some Solutions for N Consecutive and Simultaneous First-Order Irreversible Kinetic Reactions with Constant Rate Coefficients"; Chem. Eng. Sci., Vol. 41, No. 1, 1986, p. 205-207; 12 Refs.; ISSN 0009-2509; CESCA

A802; A931; A604; 1 - Crushing and Grinding; Materials - Grinding; Powders - Grinding; Mass Conservation; Neutron Flux; Decay Constants

Treat: T (Theoretical); X (Experimental)

The application of the authors equations to chemical reactions in which mass is conserved is self-evident. However, the equations do not actually require mass conservation, and the values of M/I or P/I which are obtained if mass is not conserved are then the mass of component I per unit mass of starting material. In applying the equations to the radioactive decay sequence it is to be noted that some of the value of K will depend on the neutron flux in the reactor volume while some will be decay constants. It is only necessary that the reactions be ordered so that reaction 1 is not affected by the other reactions, reaction 2 is affected only by reaction 1, reaction 3 by reactions 1 and 2, etc.

3007 Pogorel'skii, K.S., Dubizhanskii, I.N., Anikin, A.I. (USSR (SU)), "Determination of the Useful Power of a Ball Mill in the Waterfall Regime Based on Non-Davis Kinematics"; Obogashch. Rud (Leningrad), No. 2, 1985, pp. 19-23; ISSN 0029-7623; OBOGA

CA148003; Grinding Ball Mill Power

Size Reduction; Power

3038 Peterson, T.W., Scotto, M.V., Sarofim. A.F. (Univ. of Arizona, Dep. of Chemical Engineering, Tucson, AZ, USA), "Comparison of Comminution Data with Analytical Solutions of the Fragmentation Equation"; Powder Technol., Vol. 45, No. 1, Nov.-Dec. 1985, pp. 87-93; 16 Refs; ISSN 0032-5910; POTEB

A533; A802; A921; 1 - Crushing and Grinding - Mathematical Models; Mathematical Techniques - Correlation Methods; Fragmentation Equation; Comminution; Similarity

Treat: T (Theoretical); X (Experimental)

Analytical solutions to the fragmentation equation are presented for specific rates of breakage and primary breakage distribution functions often used to correlate comminution data. These solutions, obtained by similarity arguments, compare favorably with the experimental data, and suggest that correlation of data via similarity techniques may facilitate determination of function parameters. (Author abstract)

3102 Vermeulen, L.A., Howat, D.D., "Quantitative Assessments of Abrasive and Impactive Wear from Ball-Size Distributions in Rotary Mills. (Pamphlet)." Mintek Rep. (1985), pp. 24, Mintek Rep. M201

41; Copper Ores, Beneficiation; Gold Ores, Beneficiation; Grinding (Comminution); Ball Mills, Service Life; White Iron, Mechanical Properties; Wear Resistance; Abrasion Resistance

New distribution functions are derived that describe the steady-state size distributions of grinding balls (of white Fe) in mills under conditions of combined abrasive and impactive wear (e.g. when grinding Cu or Au ores). Previously derived and reported size-distribution functions that are applicable under conditions of purely abrasive or purely impactive wear are shown to be special cases of the more general formulae derived in the present work. The new distribution functions are applied to all the data on ball-size distributions found in the literature, and it is shown that quantitative assessments can be made of the abrasive and impactive components in the total rate of ball wear. The correlation between the calculated values and the known conditions that prevailed in the mills is good. This clearly indicates that such assessments can be used in the optimization of the metallurgical and chemical characteristics of grinding balls for any given application. 3 Ref.

3127 Chen Ziming (Beijing General Research Inst. of Mining & Metallurgy, China), "Mechanistic Model of Autogenous Milling and Its Simulator Used for Studying and Predicting"; Yu Se Chin Shu, Vol. 37, No. 1, Feb. 1985, pp. 46-66; 18 Refs.; YSCSA

A531; A533; A921; A922; 1 - Ore Treatment - Crushing and Grinding; Mathematical Models; Probability; Self Breakage; Abrasion Breakage; Medium Breakage; Autogenous Mill

Treat: A (Applications); T (Theoretical)

The model divided breakage of autogenous grinding into three parts: self breakage, breakage by the medium and abrasion breakage. Basing on the energy balance principle, an equation for the calculation of the critical self breakage size and one for that of the critical medium size were developed. A probability distribution among the three was analysed and a distribution function of probabilities which would change with the kind of mill content was provided. On the breakage function of abrasion breakage, the author developed a "two-side distribution density function" for ore containing clay. To calculate the reasonable filling of an autogenous mill, a contoroveech formula used for the ball mill was

improved to suite the autogenous mill. Assuming there is a random process for each grinding interval, then a nonhomogenous Markov chain could be used for reflecting the whole grinding procedure. (Edited author abstract). In Chinese.

3129 Okunev, A.E., Tikhonov, O.N. (G.V. Plekhanov Mining Inst. Leningrad, USSR), "Prediction of Size Characteristic of the Final Product of a Closed Comminution Cycle"; Sov. Min. Sci., Vol. 21, No. 4, July-Aug. 1985, pp. 349-351; 2 Refs.; ISSN 0038-5581; SMNSA

A533; A921; 1 - Ore Treatment - Crushing and Grinding; Granular Materials; Particle Size Analysis; Grinding Rate; Comminution Cycle

Treat: T (Theoretical)

In the theory and practice of comminution, prediction of the granular composition of the comminuted product is a pressing problem. The aim of the present work is to obtain a formula predicting the size of the comminuted product from a continuous commercial closed cycle on the basis of data on the filling of the mill by material to be comminuted, the productivity of the mill with respect to fresh ore, and the circulating load.

3131 Robert, M., Disand, A., Sauter, D., Richard, A. (Inst. Natl. Polytecnique de Lorraine, Nancy, Fr), "Theoretical Models and Process Representation Models of the Fragmentation Processes in Ore Treatment / Modeles de connaissance et modeles de representation des processus de fragmentation dans le traitement des minerais"; Ind. Miner. Tech., No. 9-84, Nov. 1984, Table Ronde, Sect. Mineralurgie, Paris, FR, Dec. 9, 1983, pp. 681-690; 13 Refs.; INMTD

A531; A533; A921; 1 - Ore Treatment - Crushing and Grinding; Crushing and Grinding - Mathematical Models; Crushers; Experimental Models; Granulometry; Continuous Crushing

Treat: G (General Review); T (Theoretical)

The paper presents two approaches to modeling ore crushing and grinding circuits. The theoretical approach is based on fundamental knowledge of the phenomena involved in crushing. The experimental model is based on observable and measurable data. Although

the approaches are different, the results correspond quite closely. In French.

3132 Pithois, P.H., Marchal, G. (Cent. de Recherches FCB, FR), "Modeling in the Field of Grinding / La modelisationdans le domaine du broyage"; Ind. Miner. Tech., No. 9-84, Nov. 1984, Table Ronde, Sect. Mineralurgie, Paris, FR, Dec. 9, 1983, pp. 715-720; INMTD

A533; A531; A723; A921; 1 - Grinding Mills - Computer Simulation; Ore Treatment - Crushing and Grinding; Computer Graphics; Mathematical Techniques - Finite Element Method; Autogenous Grinder; Grinder Design; Ball Mills

Treat: G (General Review); T (Theoretical)

Until recently, only models simulating the stress field were used for sizing grinding mills. This method requires long and costly measurement campaigns and has certain technical limitations. Therefore, the method of finite elements was applied to the design of grinding mills. It proved to be very efficient and precise in the determination of maximum effective stresses in ore and mineral grinding operations. In French.

3135 Wedekind, Maria, Schubert, Heinrich (Bergakademie Freiberg, East Ger.), "On Material and Particle Shape Effects on the Crushing Function in Single Particle Size Reduction / Zum Einfluss von Stoffart und Kornform auf die Bruchfunktion bei der Einzeklorndruckzerkleinerung"; Neue Bergbautech., Vol. 14, No. 5, May 1984, pp. 184-188; 11 Refs; ISSN 0369-3643; NEBBA

A533; A912; A941; A943; A921; 1 - Crushing and Grinding - Research; Particle Size Analysis - Mathematical Models; Single Particle Crushing; Particle Shape Effect; Crushing Function

Treat: N (Numeric/Statistical); X (Experimental)

The article presents some research work on the effects of material type and particle shape on the crushing function using the method of single particle size reduction. In German.

3138 Armstrong, D.G., "Alternative Grindability Test. An Improvement of the Bond Procedure"; Int. J. Miner. Process, Vol. 16, No. 3-4, March 1986, pp. 195-208; 8 Refs.; ISSN 0301-7516; IJMPB

A604; A533; 1 - Grinding Mills; Ore Treatment - Crushing and Grinding; Bond Work Index; Power Requirement; Wet Plant Grinding

Treat: A (Applications); T (Theoretical)

Manufacturers of mining machinery and designers of mineral processing plants have difficulty in specifying exact size of grinding mills for grinding a particular ore or mineral from one particle size to another size at a specified rate. If the power requirement for carrying out the specified duty is known, mill manufacturers can select a size of ball or rod mill that will draw the required power. Bond carried out extensive experimental work for the mill manufacturer Allis Chalmers in the USA and devised a standard laboratory test for determining the power requirement, or grindability, that the called the work index for any particular material. In the Bond test and in the calculations for determining the Bond work index, there are certain features that are often misunderstood and lead to errors. Some of these features are discussed and reasons are given for adopting an alternative test.

3143 Forssberg, Eric; Hongzin, Zhai (Lulea Univ. of Technology Lulea, Swed.), "Quantitative Model for the Residence Time Distribution and Its Application in Studying the Malmberget Plant Grinding System"; Scand. J. Metall., Vol. 15, No. 1, 1986, pp. 41-48; 8 Refs.; ISSN 0371-0459; SJMLA

A533; A531; A931; A922; A801; 1 - Grinding Mills - Ball Milling; Ore Treatment - Crushing and Grinding; Flow of Solids - Mathematical Models; Solids - Trace Analysis; Tumbling Mills; Residence Time Distribution; Mass Transport Behaviour

Treat: N (Numeric/Statistical); T (Theoretical); X (Experimental)

A quantitative model for the residence time distribution (RTD) in tumbling mills is derived. This midel has a relatively simple form described in terms of only three characteristic parameters, which can be easily generated from multiple regression analysis by computer. The advantages of the model are very easy to understand and quite convenient to use for predicting

the transport behaviour of particles flowing through tumbling mills. More than 500 experimental data points obtained from industrial and pilot scales fit the model with sufficient accuracy. (Author abstract)

3149 Menacho, J., Concha, F. (Min. Metall. Res. Cent., Cimm, Santiago, Chile (CL)), "Mathematical Model of Ball Wear in Grinding Mills. I. Zero-Order Wear Rate"; Powder Technol., Vol. 47, No. 1, 1986, pp. 87-96; ISSN 0032-5910; POTEB

CA148003; Ball Wear Grinding Mill Model

Wear; Size Reduction

3150 Purker, P., Agrawal, Renu, Kapur, P.C. (Indian Inst. of Technology, Kanpur, India), "G-H Scheme for Back-Calculation of Breakage Rate Functions from Batch Grinding Data"; Powder Technol., Vol. 45, No. 3, Feb. 1986, pp. 281-286; 15 Refs.; ISSN 0032-5910; POTEB
A804; A802; A921; A922; A483; 1 - Powders - Crushing and Grinding; Crushing and Grinding - Mathematical Models; Grinding Mills - Optimization; Rock - Crushing and Grinding; Breakage Rate Functions; Batch Grinding; Non-Linear Optimization; Linear Least-Squares Techniques

Treat: T (Theoretical); X (Experimental)

Current methods for the estimation of breakage rate functions employ non-linear optimization techniques to back-calculate from the grinding data the parameters in an assumed functional representation of these grinding rate parameters. We present an alternate G-H scheme which can be executed by the simpler and faster linear least-squares techniques to provide satisfactory estimates of the individual grinding rate parameters without the imposition of any functional form. The proposed scheme is based on an approximate G-H solution to the discrete size grinding equation in which the lumped parameters G and H appear linearly and hence these can be readily computed. (Edited author abstract)

3154 Tenchov, B.G., Yanev, T.K. (Bulgarian Acad. of Sciences, Sofia, Bulg.), "Weibull Distribution of Particle Sizes Obtained by Uniform Random Fragmentation"; J. Colloid Interface Sci., Vol. 111, No. 1, May 1986, pp. 1-7; 14 Refs; ISSN 0021-9797; JCISA

A802; A922; A801; A804; 1 - Crushing and Grinding; Probability; Suspensions; Weibull Distributions; Uniform Random Fragmentation; Sample Preparation; Lipids

Treat: T (Theoretical); X (Experimental)

It is shown that certain processes of random fragmentation called "uniform random fragmentation" lead to particle size distributions identical with the Weibull external probability distribution. The practical application of this result is illustrated on some examples involving experimental data.

3212 Conway, Joseph C. Jr., Kirchner, Henry P. (Ceramic Finishing Co., State College, PA, USA), "Crack Branching as a Mechanism of Crushing During Grinding"; J. Am. Ceram. Soc., Vol. 69, No. 8, Aug. 1986, pp. 603-607; 29 Refs; ISSN 0002-7820; JACTA

A812; A604; A421; 1 - Ceramic Materials - Grinding; Materials - Crack Propagation; Silicon Carbide; Silicon Nitride; Glass; Crushing Mechanism; Groove Depths; Stress Intensity Factors

Treat: A (Applications); T (Theoretical); X (Experimental)

A crushing model, based on a crack-branching mechanism of crushing, an elastic analysis of the stress distribution and a critical stress intensity factor criterion for the extent of crack propagation, was used to estimate the extent of crushing under a diamond point subjected to an inclined load. The depths of the crushed region were compared with the groove depths formed in several materials during single-point grinding under similar loading conditions. Good agreement was observed between the absolute values of the groove depths and crushing depths, and the load dependence of these values for soda-lime glass. In the case of silicon nitride and silicon carbide, there was good agreement between the calculated and the experimental load dependencies but the absolute values of the experimentally determined groove depths were somewhat smaller than the calculated crushing depths. (Author abstract)

3226 Narayanan, S. Sankara (Univ. of Queensland, Brisbane, Aust.), "Single Particle Breakage Tests: A Review of Principles and Applications to Comminution Modelling"; Bull. Proc. Australas. Inst. Min. Metall., Vol. 291, No. 4, June 1986, pp. 49-58; 121 Refs; ABPRE

A533; A802; 1 - Crushing and Grinding - Mathematical Models; Grinding Mills - Ball Milling; Particle Breakage Tests; Size Reduction

Treat; A (Applications); G (General Review)

Single particle breakage tests have been used by a number of researchers to investigate some salient features of the complex comminution process. The characteristics of the common single article breakage tests such as single impact, double impact and slow compression tests are examined and the results from these tests are compared. A comparison of the results from single particle breakage tests with grindability and ball mill tests is given. Application of the results from single particle breakage tests to modelling industrial comminution processes is described. The necessity for further research into single particle breakage tests to develop a simple but comprehensive technique for estimating the breakage characteristics of ores is discussed. (Author abstract)

1986 (F) PROCESS ANALYSIS, EFFECTS

2905 Meric, J.P. (Cent. Etud. Rech. Ind. Liants Hydraul., Paris, Fr. (FR)), "Influence of Grinding and Storage Conditions of Clinker"; Int. Congr. Chem. Cem., (Proc.). 7th, Vol. 1, 1980, pp. I/4-1-I/4/16; 48JWA; Pub: Septima, Paris, Fr.
CA158000; Review Cement Grinding

Cement, Energy

2928 Durose, K., Fellows, A.T., Brinkman, A.W., Russell, G.J., Woods, J. (Dep. Appl. Phys. Electron., Univ. Durham, Durham, UK (GB)), "Structural Aspects of Ball Milled Cadmium Sulfide and Cadmium Selenide"; J. Mater. Sci., Vol. 20, No. 10, 1985, pp. 3783-9; ISSN 0022-2461; JMTSA

CA175007; Deformation Cadmium Chalcogenide Ball Milling; Phase Transition Cadmium Chalcogenide Ball Milling; Sulfide Cadmium Deformation Ball Milling; Selenide Cadmium Deformation Ball Milling

1306-24-7; 1306-23-6

2933 Dokuchaeva, I.N.; Zakharova, L.A., (DGI, USSR (SU)), "Evaluation of the Grindability of Intermediate Products in the Beneficiation of Ferruginous

Quartzites"; Gorn. Zh., No. 12, 1985, pp. 44-45; ISSN 0017-2278; GOZHA

CA154001; Iron Ore Grinding Classification; Magnetic Sepn. Iron Ore Grinding

Iron Ores; Magnetic Field; 1309-38-2

2944 Aglietti, E.F., Porto Lopez, J.M., Pereira, E. (Cent. Tecnol. Recursos Miner. Ceram., Buenos Aires, Argent. (AR)), "Mechanochemical Effects in Kaolinite Grinding. I. Textural and Physicochemical Aspects"; Int. J. Miner. Process., Vol. 16, No. 1-2, 1986, pp. 125-133; ISSN 0301-7516; IJMPB

CA157005; Kaolinite Grinding Physicochem. Property

Size Reduction; 1318-74-7

2945 Aglietti, E.F., Porto Lopez, J.M., Pereira, E. (Cent. Tecnol. Recursos Miner. Ceram., Buenos Aires, Argent. (AR)), "Mechanochemical Effects in Kaolinite Grinding. II. Structural Aspects"; Int. J. Miner. Process., Vol. 16, No. 1-2, 1986, pp. 134-146; ISSN 0301-7516; IJMPB

CA157005; Kaolinite Structural Disorder Grinding

Size Reduction; 1318-74-7

2950 Hoberg, H., Loesche, T., Schneider, F.-U., "Studies of the Floatability of Sulfides after Dry Grinding: A Contribution to the Development of an Alternative Energy-Saving Method for the Preparation of Sulfide Ores / Untersuchungen zur Flotierbarkeit von Sulfiden nach Trockenmahlung: ein Beitrag zur Entwicklung eines Alternativen Energiesparenden Aufbereigungsverfahrens fuer Sulfidische Erze"; Aufbereit Tech., Vol. 26, No. 4, Apr. 1985, pp. 171-182; 15 Refs.; ISSN 0004-783X; AUFTA

A533; A901; A802; 1 - Ore Treatment - Crushing and Grinding; Crushing and Grinding - Energy Conservation; Flotation - Efficiency; Floatability; Roller Mills

Treat: X (Experimental)

For certain types of ore the roller mill can offer an energy-saving alternative to wet grinding in the ball mill. As sulfides have hydrophobic (water-repellent) properties, which are preserved or even enhanced in the dry grinding process, such grinding could be further advantageous in enabling the flotation of sulfide ores

to be achieved without, a collector or with only a little help from one. In systematic laboratory inventories it was found that, after dry grinding in this way, a higher metal yield and in some instances also higher concentrations could be attained in comparison with the usual flotation after wet grinding. Particular advantages can be expected in the flotation of very fine-grained materials. (Edited author abstract). In German and English.

2953 Reddy, P.S.R., Sastri, S.R.S., Narasimhan, K.S. (Bhubanewswar, India (IN)), "Effect of Feed Rate on Product Size in Open Circuit Grinding"; Aufbereit Tech., Vol. 26, No. 10, 1985, pp. 591-593; ISSN 0004-783X; AUFTA

CA154001; Chromite Ball Mill Grinding

Particle Size; 1308-31-2

2954 Freedman, Marc R., Kiser, James D., Herbell, Thomas P. (Lewis Res. Cent., Natl. Aeronaut. Space Adm., Cleveland, OH, USA, 44135 (US)), "Factors Influencing the Ball Milling of Silicon Nitride (SI3N4) in Water"; Ceram. Eng. Sci. Proc., Vol. 6, No. 7-8, 1985, pp. 1124-1134; ISSN 0196-6219; CESPD

CA157002; Silicon Nitride Milling

Ceramic Materials and Wares; Size Reduction; 12033-89-5

2957 Moroz, V.F., Ol'Khovik, S.B., "Influence of Comminution on the Structure and Properties of Magnetite"; Russ. Metall. Met. No. 5, 1985, pp. 8-12; 9 Refs; ISSN 0036-0295; RMLYA

A533; A933; 1 - Iron Ore Treatment - Crushing and Grinding; Crystals - Structure; Grinding Mills - Ball Mililng; Comminution; Magnetite; Inverted Spinel; Ball Vibrational Mill

Treat: X (Experimental)

The influence of comminution on the properties of magnetite has been investigated by Moessbauer, X-ray structural, and magnetometric methods of analysis. It is shown that this influence is due to microdistortions associated with the accumulation of crystal-structure defects in samples. Their predominant influence is on the interaction of Fe-O in octahedral positions. On comminution in air, the distortions of the crystal

structure are larger than on comminution in ethyl alcohol.

3005 Zadorozhynyi, V.K., Rakaw, A.I., Bilenko, L.F. (USSR (SU)), "Increasing the Selectivity of Ore Grinding by Preliminary Softening"; Obogashch. Rud (Leningrad), No. 5, 1985, pp. 2-4; ISSN; 0029-7623; OBOGA

CA154001; Rare Ore Grinding Elec. Discharge

Electric Discharge; Ore Treatment

3006 Zlatorunskaya, G.E. (USSR (SU)), "Evaluation of the Grindability of an Ore from its Particle Size Distribution"; Obogashch. Rud (Leningrad), No. 2, 1985, pp. 5-7; ISSN 0029-7623; OBOGSA

CA154001; Apatite Nepheline Ore Grinding Control

Ore Treatment; Apatite-Group Minerals; Process Control and Dynamics; 1302-72-3

3008 Yatsenko, A.A., Peskov, A.A., Serpionov, Yu A., "Study of Some Types of Media for Fine Milling of Compact Copper - Nickel Ores"; Tsvetn. Met. (1985), (11) 80-83; ISSN 0372-2929

41; Copper Ores, Beneficiation; Nickel Ores, Beneficiation; Ball Milling; Jaw Crushers

Optimization of milling medium composition for each stage of the milling operation made it possible to intensify the fine milling process for compact sulfide ores in ball milling equipment. For the first stage of the process, in which the strength of the sulfide ores is low, balls of 60, 80 and 100 mm or 40 and 100 mm dia. were recommended. In the second stage of the process, it was recommended that the 40 μm dia. balls be replaced with cylindrical cast iron milling media. The finishing stage was significantly accelerated by using mixed media composed of balls and cubes with concave edges. 5 ref.

3010 Chertkov, V.Ya. (All-Union Scientific-Research & Planning Inst. of Building Materials Sources, Moscow, USSR), "Relationship of Zones of Buckling Crushing, Fragmentation, and Radial Fracturing with Critical Microfracturing"; Sov. Min. Sci., Vol. 20, No. 5, Sep-Oct. 1984, pp. 381-384; 9 Refs; ISSN 0038-5581; SMNSA

A483; A502; A421; A931; A921; 1 - Rock - Explosions; Stresses - Analysis; Fracture Mechanics - Mathematical Models

Treat: T (Theoretical)

Zones of buckling crushing (fine pulverization) and fragmentation appear around a borehole when the pressure pulse of the detonation products is quite strong. On the basis of kinetic concepts of the nature of destruction, the author presents, with reference to granite, theoretical evaluations of the amplitude stresses at the boundaries of the buckling crushing and fragmentation zones (1), the dimensions of these zones (2) and the possible dimensions and the number of the radial cracks (3).

3015 Petruk, W., Pinard, R.G., Finch, J. (CANMET, Mineral Processing Lab., Ottawa, Ont. Can), "Relationship between Observed Mineral Liberations in Screened Fractions and in Composite Samples"; Miner. Metall. Process, Vol. 3, No. 1, Feb. 1986, pp. 60-62; 4 Refs; MMPRE

A533; A801; A741; 1 - Ore Treatment - Crushing and Grinding; Crushing and Grinding - Sampling; Ore Analysis; Imaging Techniques; Image Processing - Image Analysis; Ore Sampling; Mineral Liberations; Screened Fractions; Narrow Size Range Screened Fractions; Tyler Size Ranges

Treat: X (Experimental)

An investigation was conducted to determine the minimum number of samples that must be studied by image anlaysis of polished sections to characterize a mill product and determine the apparent mineral liberation. It is assumed that results obtained by combining data for a series of narrow size range screened fractions (one Tyler size range) are representative of the sample, and relatively accurate apparent mineral liberation data can be obtained for a mill product by analyzing each fraction and combining the data. Somewhat less accurate data would be obtained by analyzing a series of screened fractions that have a wider size range of particles (five Tyler size ranges). (Edited author abstract).

3016 Dunne, R.C., Liddell, S.J. (Counc. Miner. Technol., Randburg, S.Afr. (ZA)), "Improved Recoveries of Gold from Auriferous Calcines and Pyrites by Fine Milling"; Report No. (Mintek M-161; Order No. PB85-210458,), 1984, p.17 PP. D*REP

From Gov. Rep. Announce. Index (U.S.), 1985, 85(20), Abstr. No. 545,155

Avail. NTIS

CA154002; Gold Recovery Milling Calcined Ore

Gold Ores; 7440-57-5

3105 Petruk, William (CANMET, Ottawa, Ont. Can, K1A 0G1 (CA)), "Image Anaysis Studies to Determine Liberations of Sphalerite, Chalcopyrite, and Galena during Grinding of Fine-Grianed Pyritic Zinc-Lead-Copper-Silver Ores"; Congr. Int. Mineralurgie, (C.R.), 15th, Vol. 1, 1985, pp. 77-87; 55CYA; Pub: Gedim, St. Etienne, Fr.

CA154001; Pyrite Ore Grinding Mineral Liberation; Copper Lead Silver Zinc Ore; Model Screen Analysis Mineral Liberation; Size Redn. App. Ore Grinding

Ore Treatment; Zinc Ores; Lead Ores; Silver Ores; Copper Ores; 1308-56-1; 12169-28-7; 12179-39-4

3106 Lin, I.J., Nadiv, S. (Dep. Miner. Eng., Technion, Haifa, Israel, 32000 (IL)), "Mechano-Chemical Modifications of Solid Particles Through Fine Grinding"; Congr. Int. Mineralurgie, (C.R.), 15th, Vol. 1, 1985, pp. 223-230; 55 CYA; Pub: Gedim, St. Etienne, Fr.

CA149000; Review Praticle Activation Grinding; Mechanochem. Activation Reaction Review

Inorganic Compounds; Size Reduction

3118 Lauer, O. "Efficiency Tests with Grinding Aids When Crushing Mineral Materials / Untersuchungen ueber die Wirksamkeit von Mahlhilfen bei der Zerkleinerung Mineralischer Stoffe"; Aufbereit Tech., Vol. 26, No. 10, Oct. 1985, pp. 569-576; 4 refs; ISSN 0004-783X; AUFTA

A533; A802; 1 - Crushing and Grinding - Moisture Control; Moisture Control - Efficiency; Grinding Aids

Treat: X (Experimental)

The effects of liquid "grinding aids" were tested in the course of crushing three different sorts of limestone, feldspar and quartz in a ball mill. The addition of small percentages of water proved highly efficient for all three limestones. Water is only slightly less efficient, and under certain conditions even more efficient than the additives propylene glycol and triethanolamine which are used in the cement industries. The efficiency of grinding aids is much lower in the case of hard materials, as is proven by the results of grinding tests with feldspar and quartz, where water is ineffective and the other two additives are less than in the case with limestone. At the start of crushing, they even impede the grinding operations. A further undesired secondary effect entailed in the use of grinding additives for hard materials is that the abrasion of the grinding elements increases considerably. (Edited author abstract). In German and English.

3122 Bocharov, V.A., "Special Features of the Oxidation of Sulfides During the Preparation of Pyrite Ores for Selective Flotation / Osobennosti Okisleniya Sul'fidov Pri Podgotovke Kolchedannykh Rud K selektivnoi Flotatsii"; Tsvet Met, N. 10, Oct. 1985, pp. 96-99; 9 Refs; ISSN 0372-2929; TVMTA

A533; A802; 1 - Copper Zinc Ore Treatment - Crushing and Grinding; Chemical Reactions - Oxidation

Treat: X (Experimental)

Oxidation of pyrite during grinding is accompanied by the formation of ferrous sulfide and elementary sulfur. Subsequent oxidation of the sulfide ion and elementary sulfur occurs according to a chain reaction. With a grinding time close to practical conditions the quantity of elementary sulfur amounts to 100 Mg per 100 g of pyrite. The most stable products of oxidation of sulfur in an alkali medium are thiosulfate ions, the concentration of which both in the oxidation of pure pyrite and in industrial-process sulfide slurries fluctuates within wide limits (50-1400 Mg/liter), depending on the pH of the liquid phase and the slurry components. In Russian.

3123 Tsimas, S., Moutsatsou, A., Parissakis, G. (Natl. Tech. Univ. Athens, Inorgan. & Analyt. Chem. Lab. Gr-147 Athens, Greece), "About the Fineness After Grinding of Cement Clinker, Slag and Other Materials in Relation to Grinding Temperature"; Zement-Kalk-Gips, Vol. 39, No. 6, 1986, pp. 330-332; Ref: 000

3126 Suzuki, Kazuo; Kuwahara, Yoshitaka (Govern. Ind. Res. Inst. Nagaya, Nagoya, Japan, 462 (JP)), "Effects of Fluids on Vibration Ball Mill Grinding"; J. Chem. Eng. Jpn., Vol. 19, No. 3, 1986, pp. 191-195; ISSN 0021-9592; JCEJA

CA148003; Wet Grinding Vibration Ball Mill; Silicon Powder Grinding Ball Mill

Size Reduction; 67-56-1; 67-64-1; 71-23-8; 78-83-1; 108-88-3; 64-17-5; 110-54-3; 7440-21-3

3139 Struk, L.I., Fedorus, V.B., Makarenko, G.N., Prilutsky, E.V., "Some Peculiarities of the Process of Boron Carbide Grinding and Pressing"; Poroshk. Metall., 1985, (6), pp. 29-33; ISSN 0032-4795

54; Cer; Boron Carbide, Powder Technology; Grinding (Comminution); Ball Milling; Particle Size Distribution; Compacting; Density; B Sub 4 C:Cer

Efficiency of technical boron carbide grinding in magnetic-vortical apparatus and planetary (ball) mill is comparatively estimated. Experimental dependences of the specific surface on the grinding period are described by the Khodakov equation. Efficiency of boron carbide grinding in the planetary mill is established to be an order of magnitude higher than in the magnetic-vortical apparatus. However, grinding in the planetary mill is accompanied by more intensive Fe grinding. Dependence of Briquette density on the pressing pressure is studied for boron carbide powders produced by different methods. Boron carbide powder pressing is described by the logarithmic dependence of relative volume on pressure. 7 ref.

3141 Aglietti, E.F., Porto Lopez, J.M., Pereira, E. (Centro de Tecnologica de Recursos Minerales y Ceramica, Buenos Aires, Argent.), "Mechanochemical Effects in Kaolinte Grinding. I Textural and Physicochemical Aspects"; Int. J. Miner. Process, Vol. 16, No. 1-2, Jan. 1986, pp. 125-133; 13 Refs; ISSN 0301-7516; IJMPB

A812; A533; A801; 1 - Kaolin - Crushing and Grinding; Surfaces - Differential Thermal Analysis; Textures; Porosimetry; Specific Surface; Crystallinity

Treat: X (Experimental)

DTA, TBA, N/2 adsorption, granulometric analysis, SEM and porosimetry indicate the formation of agglomerates with high specific surface area and the gradual loss of

crystallinity. The material maintains its chemical composition, evidencing the absence of thermal effects. The material obtained has high surface residual charges and high reactivity toward acid dissolution. (Edited author abstract).

3142 Forssberg, Eric, Hongzin, Zhai (Lulea Univ. of Technology, Lulea, Sweden), "3rd Behaviour of the Key Parameters Affecting Grinding in a Batch Ball Mill"; Scand. J. Metall, Vol. 15, No. 1, 1985, pp. 53-58; 11 Refs; ISSN 0371-0459; SJMLA

A533; A731; A943; 1 - Grinding Mills - Control; Control, Mechanical Variables - Volumes; Ore Treatment - Crushing and Grinding; Particle Size Analysis; Grinding Fineness; Net Energy Consumption; Batch-Type Ball Mill

Treat: X (Experimental)

To obtain an extensive understanding of the behaviour of the key parameters in grinding processes, factorial design is applied to a ball mill test using four variables, each at three levels. This required a total of 27 tests. The influence of charge volume, mill speed, feed and pulp density on grinding fineness and net energy consumption were related and inorder by multiple regression analysis. The computer-based response surfaces of the dependent variables demonstrated the combined effects of the operational parameters. They also provided a base for further tests on the multiple influence of the process variables on continuous grinding (Author abstract).